Lecture 13:
Panel data III

PPHA 34600

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An example: Biking to school for girls

Policy issue:

- Large gender gaps in education persist in developing countries
- We want to increase girls' participation in schooling
- How do we accomplish this?

Approach:

- Program to provide girls with bikes
- Estimate the impacts of cycling program on schooling
- We didn't randomize bikes
- ...but we can do a girls-vs-boys, pre-vs-post, Jharkhand-vs-Bihar comparison

$\rightarrow$ Use a DDD model to estimate treatment effects

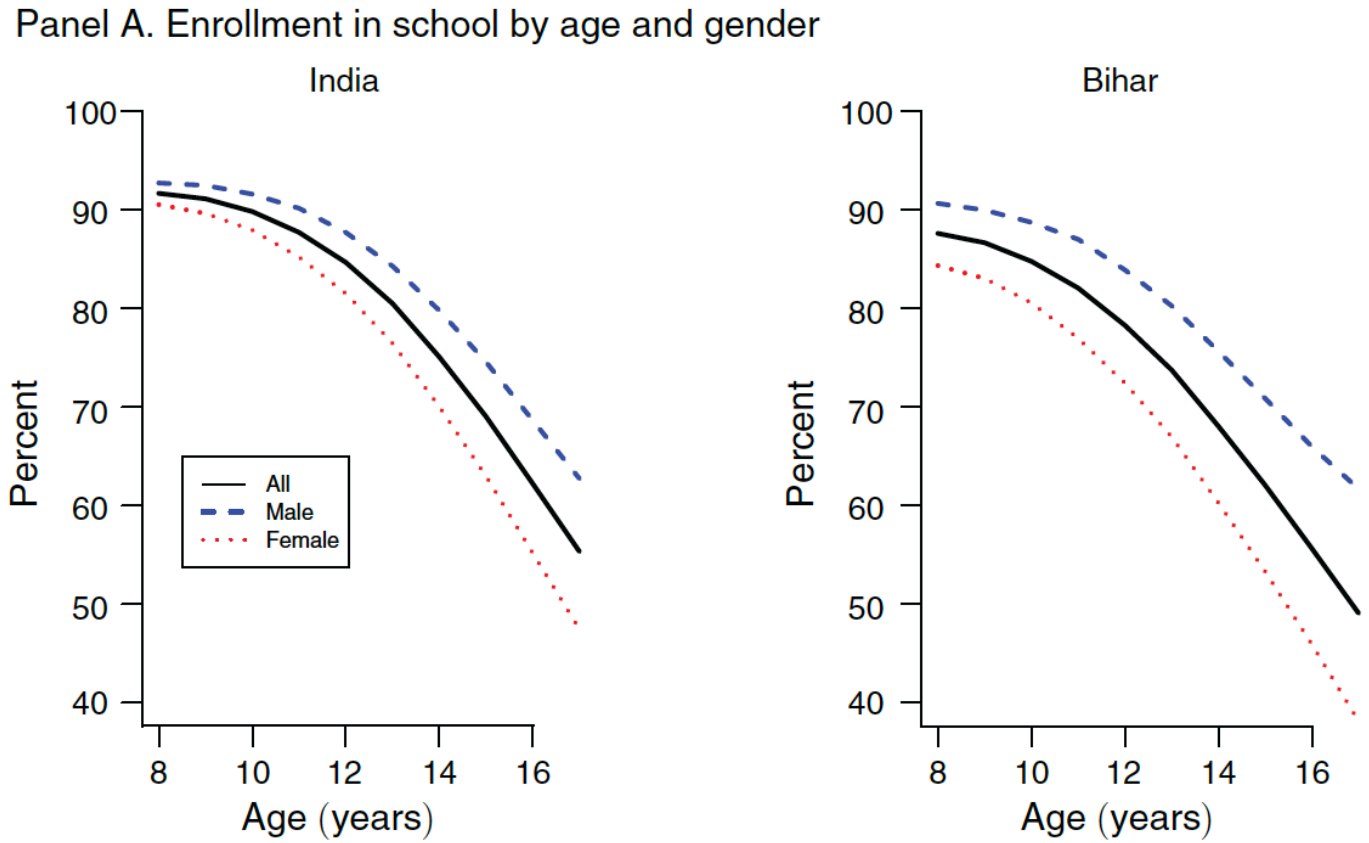
Estimating the effects of the Cycle program

The authors will run a version of:

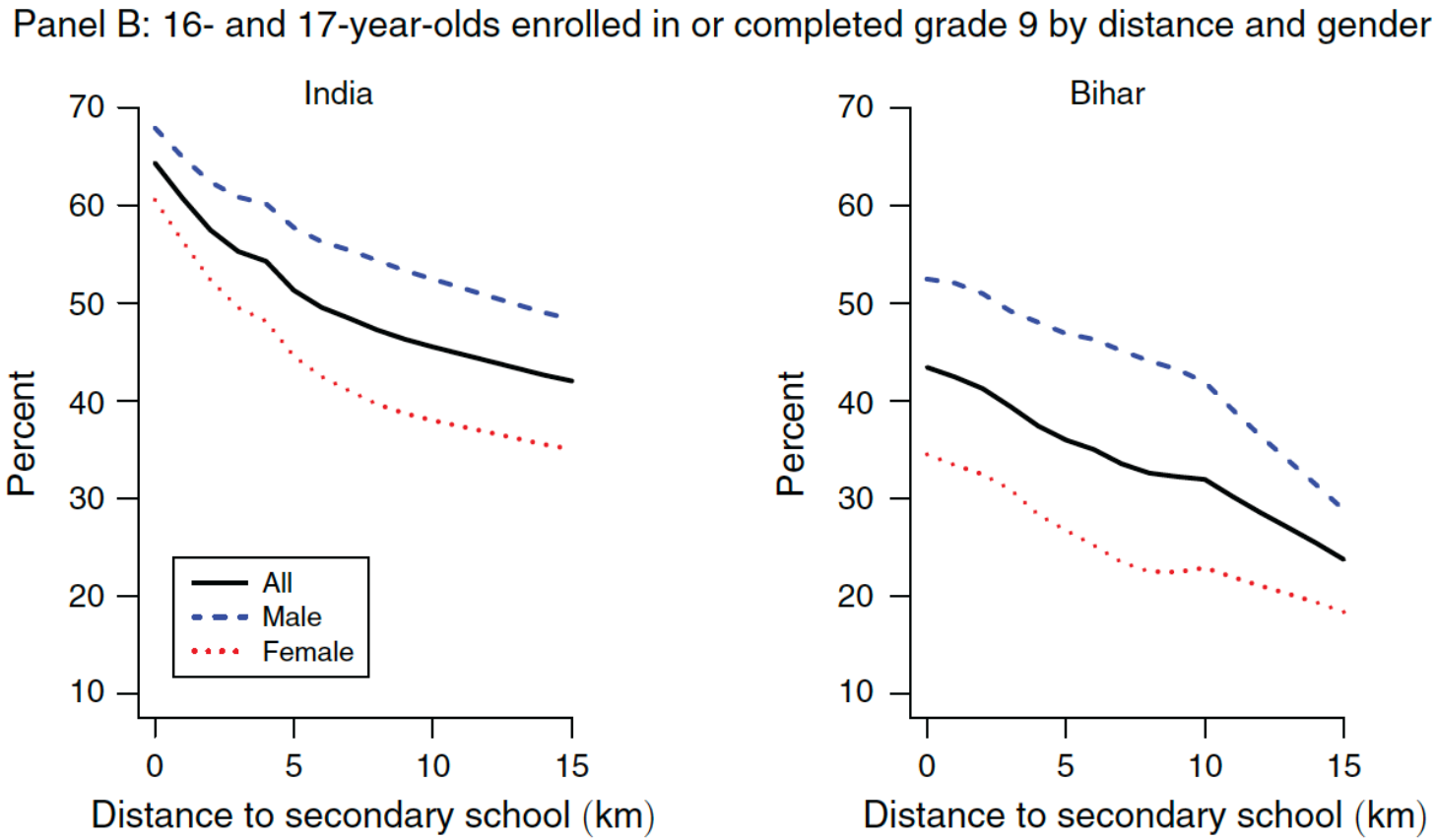
$$\begin{aligned} Y_{ijt} = \beta_0 &+ \beta_1 Girl_i + \beta_2 YoungCohort_t + \beta_3 State_j + \beta_4 (Girl_i \times Post_t) \\ &+ \beta_5 (YoungCohort_t \times State_j) + \beta_6 (Girl_i \times State_j) \\ &+ \tau (Girl_i \times YoungCohort_t \times State_j) + \varepsilon_{ijt} \end{aligned}$$

where
Y_{ijt} is education for person i in time t in state j
$Girl_i \times YoungCohort_t \times State_j$ turns on for girls in Bihar in young cohorts

Gender gaps in schooling



Gaps by distance



Test of parallel trends

TABLE 1—TESTING THE PARALLEL TRENDS ASSUMPTION

Dependent variable: log (9th grade enrollment by school, gender, and year)	
Panel A. Testing parallel trends for the difference-in-differences (DD)	
Female × year	**0.0518**
	(0.00)
Female	−0.870
	(0.06)
Year (coded as 1 to 4)	0.0852
	(0.01)
Constant	4.235
	(0.05)
Observations	20,266
R^2	0.167
Panel B. Testing parallel trends for the triple differences (DDD)	
Female × year × Bihar	**−0.0100**
	(0.01)
Female × year	0.0618
	(0.01)
Female × Bihar	0.175
	(0.11)
Bihar × year	0.0290
	(0.01)
Female	−1.045

Treatment effects

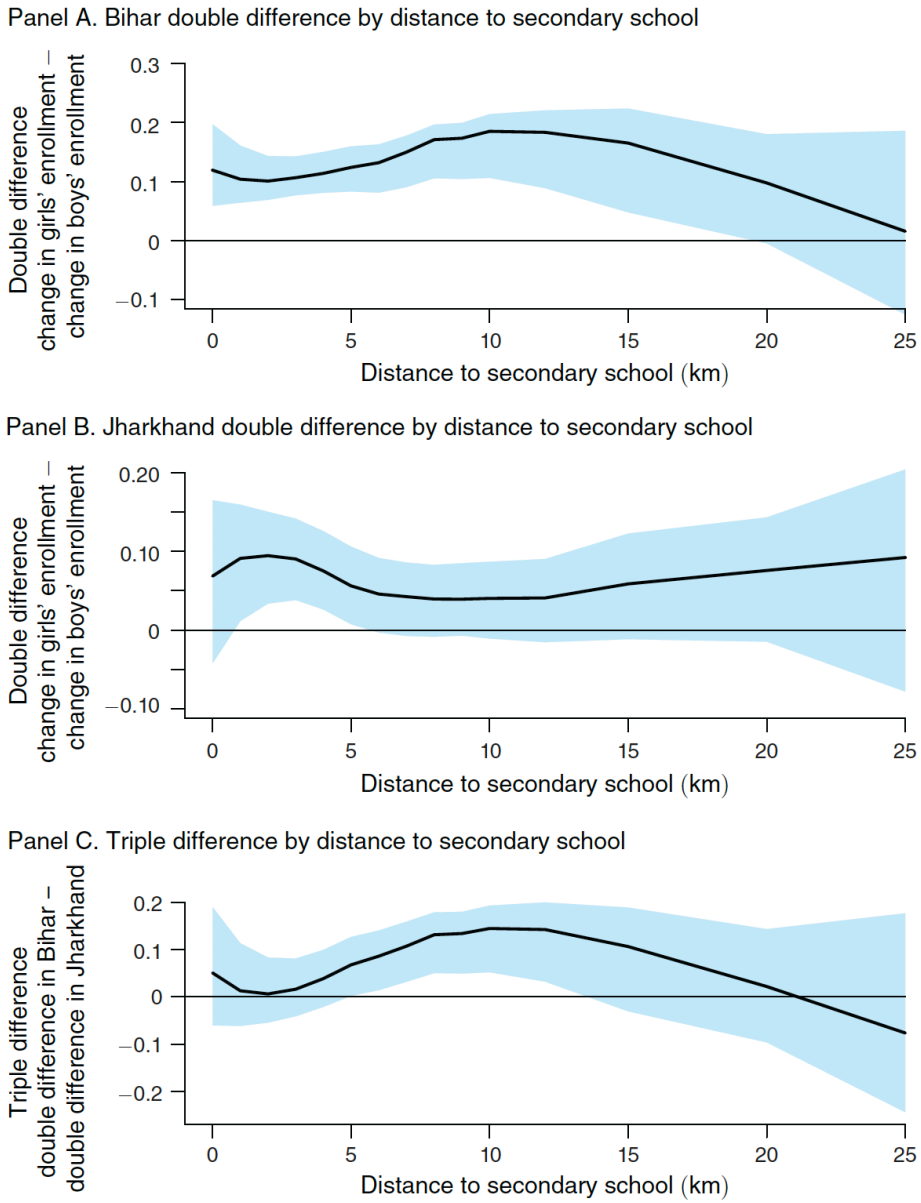
Dependent variable: Enrolled in or completed grade 9				
Treatment group = age 14 and 15 Control group = age 16 and 17	(1)	(2)	(3)	(4)
Treat × female × Bihar	**0.103** **(0.030)**	**0.091** **(0.029)**	**0.052** **(0.025)**	**0.052** **(0.025)**
Treat × female	0.020 (0.026)	0.024 (0.026)	0.038 (0.021)	0.039 (0.021)
Treat × Bihar	−0.044 (0.018)	−0.042 (0.018)	−0.029 (0.016)	−0.028 (0.016)
Female × Bihar	−0.094 (0.023)	−0.091 (0.023)	−0.067 (0.020)	−0.066 (0.020)
Treat	−0.148 (0.014)	−0.143 (0.014)	−0.138 (0.013)	−0.138 (0.013)
Female	−0.092 (0.020)	−0.088 (0.020)	−0.100 (0.017)	−0.101 (0.017)
Bihar	0.011 (0.016)	−0.044 (0.016)	−0.032 (0.015)	−0.044 (0.015)
Constant	0.464 (0.013)	0.771 (0.024)	0.593 (0.027)	0.562 (0.040)
Demographic controls	No	Yes	Yes	Yes
HH socioeconomic controls	No	No	Yes	Yes
Village level controls	No	No	No	Yes
Observations	30,295	30,295	30,147	30,112
R^2	0.035	0.088	0.207	0.208

Treatment effects by distance

TABLE 3—QUADRUPLE DIFFERENCE (DDDD) ESTIMATE OF THE IMPACT OF BEING EXPOSED TO THE CYCLE PROGRAM ON GIRL'S SECONDARY SCHOOL ENROLLMENT BY DISTANCE TO SECONDARY SCHOOL

Dependent variable: Enrolled in or completed grade 9				
Treatment group = age 14 and 15 Control group = age 16 and 17	(1)	(2)	(3)	(4)
Treat × female × Bihar × long distance indicator	**0.094** **(0.058)**	**0.088** **(0.056)**	**0.088** **(0.050)**	**0.087** **(0.050)**
Treat × female × long distance indicator	−0.079 (0.050)	−0.080 (0.048)	−0.074 (0.043)	−0.073 (0.043)
Treat × female × Bihar	0.043 (0.041)	0.034 (0.039)	−0.005 (0.038)	−0.004 (0.038)
Female × Bihar × long distance indicator	−0.083 (0.045)	−0.075 (0.043)	−0.069 (0.039)	−0.070 (0.039)
Treat × Bihar × long distance indicator	−0.029 (0.036)	−0.025 (0.036)	−0.009 (0.033)	−0.009 (0.033)
Treat × female	0.072 (0.035)	0.077 (0.033)	0.088 (0.032)	0.087 (0.032)
Treat × long distance indicator	0.037 (0.029)	0.039 (0.029)	0.032 (0.026)	0.031 (0.026)
Treat × Bihar	−0.023 (0.027)	−0.022 (0.027)	−0.018 (0.025)	−0.018 (0.025)
Female × long distance indicator	0.065 (0.038)	0.063 (0.037)	0.058 (0.033)	0.057 (0.033)
Female × Bihar	−0.042 (0.032)	−0.043 (0.031)	−0.023 (0.029)	−0.022 (0.029)
Bihar × long distance indicator	0.014 (0.034)	0.022 (0.032)	0.007 (0.028)	0.008 (0.028)
Treat	−0.172 (0.023)	−0.168 (0.022)	−0.159 (0.021)	−0.159 (0.021)
Female	−0.135 (0.028)	−0.130 (0.026)	−0.138 (0.025)	−0.139 (0.025)
Bihar	−0.009 (0.026)	−0.066 (0.024)	−0.043 (0.021)	−0.054 (0.021)
Long distance indicator	−0.075 (0.028)	−0.073 (0.026)	−0.044 (0.023)	−0.040 (0.023)
Constant	0.513	0.816	0.622	0.587

Triple difference in distance



Impacts on tests

Triple difference (DDD) estimate of impact of exposure to cycle program		
Dependent variable	log (number of candidates who appeared for the 10th grade exam)	log (number of candidates who passed the 10th grade exam)
	(1)	(2)
Bihar × female × post	**0.184**	**0.122**
	(0.065)	**(0.068)**
Female × Bihar	−0.266	−0.224
	(0.046)	(0.047)
Bihar × post	0.083	0.021
	(0.045)	(0.047)
Female × post	0.138	0.117
	(0.056)	(0.058)
Female	−0.628	−0.697
	(0.039)	(0.040)
Bihar	0.239	0.213
	(0.032)	(0.032)
Post	0.247	0.171
	(0.040)	(0.041)
Constant	4.510	4.280
	(0.028)	(0.028)
Observations	15,694	15,630
R^2	0.175	0.156