

CYCLING TO SCHOOL: INCREASING SECONDARY SCHOOL ENROLLMENT FOR GIRLS IN INDIA

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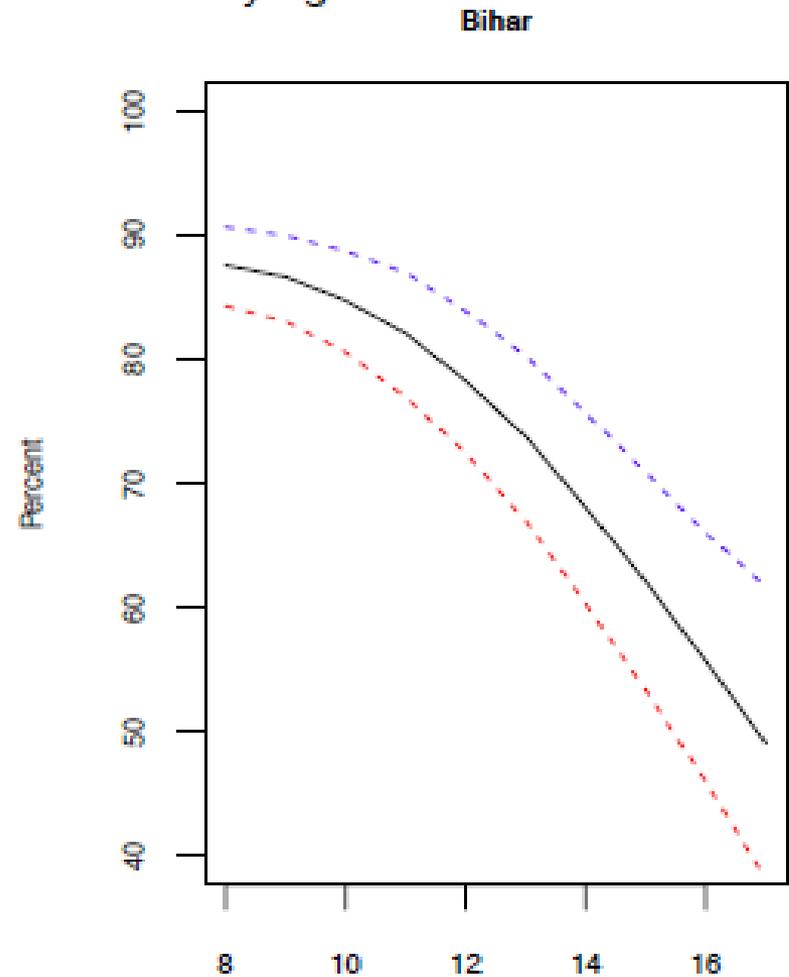
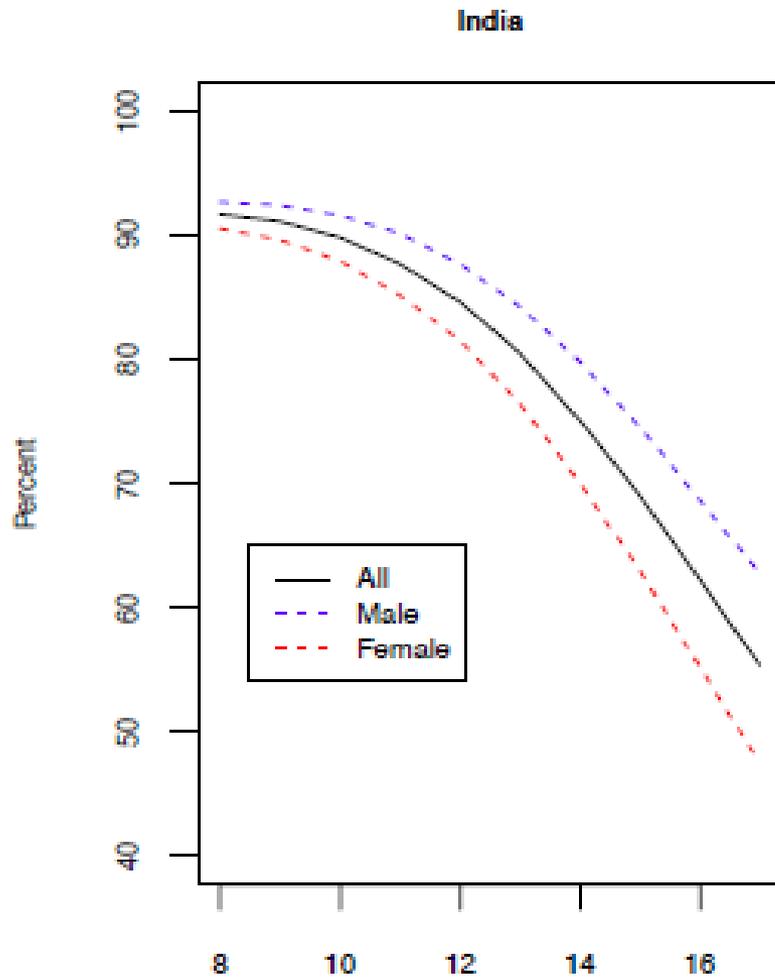
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Background/Motivation

- Increasing female school attainment is one of the MDG's
- Improving female education directly contributes to the 'inclusive growth' agenda of the Government
 - ▣ Growth – by increasing human capital of the labor force
 - ▣ Inclusive – by allowing more people to participate in the growth process
- Large gender gaps in India (and especially in Bihar) in school attendance (grows with age)
- Primary schools now exist within 1 km of most villages
- But distance is still an important barrier to secondary school attendance (again, more so for girls)

School Enrollment by Age & Gender

Panel A: Enrollment in School by Age



Policy Intervention

- In 2006, GoB initiated a program to provide bicycles to all girls studying in classes 9 and 10
 - ▣ Grant of Rs. 2000/student (~\$40); now Rs. 2500 (~\$50)
- No direct provision of bicycles – cash provided to eligible students through the schools, and receipts for purchase of cycles were collected (not a typical CCT that goes to HH budget)
- This was effectively a CKT program and was one of India's first scaled up CT program for girl's secondary education
- Unique hybrid of demand and supply-sided intervention
 - ▣ Enrolment conditionality resembles a traditional CCT
 - ▣ But cycles improve school access by reducing the distance cost of attendance (also allows economies of scale in school quality)
- High-profile program, politically very visible (and also copied)
 - ▣ Concerns include fake enrolments, and leakage of funds
 - ▣ What was the impact of the program?



Picture Credits: Abhinav Nayar



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This Paper

- Aims to:
 - ▣ Evaluate impact on secondary school enrolment (and learning outcomes) for girls
 - ▣ Disentangle the mechanism of impact (conditionality vs. cycle)
 - ▣ Evaluate its cost effectiveness and draw broader lessons
- Main challenge for the empirical analysis is that the program was implemented state-wide (no clear control group)
 - ▣ Boys (double difference)
 - ▣ Jharkhand (triple difference)
- Even if you get an effect, there may be multiple mechanisms:
 - ▣ Conditionality; Bicycle; Third factors (other programs, returns)
- If the impact was because of the cycle itself, we should see differential impacts by distance to school
 - ▣ Quadruple difference (by distance)
 - ▣ Plot triple-difference by distance (non-parametric)

Data and Estimation Strategy

- We use the 2008 District-Level Health survey (DLHS)
 - ▣ Representative sample of ~1,000 HH/district (total sample ~50,000 HH)
 - ▣ Family roster with education histories
 - ▣ Village data includes distance to nearest secondary school
- Survey conducted ~1.5 years after MBCY launched
 - ▣ So we treat 14-15 year olds as 'treated' cohorts and 16-17 year olds as 'control' cohorts (as in Duflo 2001)
 - ▣ Dependent Variable: Enrolled in or completed class 9
 - ▣ 14-15 vs. 16-17 year old girls (first difference)
 - ▣ Compare with corresponding difference for boys (second difference)
 - ▣ Compare double difference across Bihar & Jharkhand (triple difference)
 - ▣ Compare triple difference by whether a village was above/below median distance to school (quadruple difference)
- We also collect official data on student learning outcomes using appearance/passing on 10th grade board exam
- Also collect official school enrollment data (for testing trends only)

Results (Double Difference)

Table 2: Diff-in-Diff (DD) Estimate for the Impact of Being Exposed to the Cycle Program on Girl's Secondary School Enrollment

Dependent variable: Enrolled in or completed grade 9

Treatment group = Age 14 and 15

Control group = Age 16 and 17

	(1)	(2)	(3)	(4)
TreatxFemale dummy	0.123*** (0.0149)	0.114*** (0.0144)	0.0903*** (0.0135)	0.0898*** (0.0134)
Treat	-0.192*** (0.0108)	-0.184*** (0.0106)	-0.167*** (0.00996)	-0.166*** (0.00997)
Female dummy	-0.186*** (0.0117)	-0.178*** (0.0112)	-0.168*** (0.0104)	-0.167*** (0.0103)
Constant	0.475*** (0.00980)	0.823*** (0.0831)	0.604*** (0.0644)	0.633*** (0.0696)
Demographic controls	No	Yes	Yes	Yes
HH socio-economic controls	No	No	Yes	Yes
Village level controls	No	No	No	Yes
Observations	18,453	18,453	18,353	18,331
R-squared	0.038	0.106	0.222	0.223

Notes: * p<0.1; ** p<0.05; *** p<0.01. Standard errors clustered by village ID are in parentheses.

Do Parallel Trends Hold (Double Diff)?

Table 3: Testing the Parallel Trend Assumption

Dependent variable: Log (9th Grade Enrollment)

PANEL A: Testing Parallel Trends in the Diff-in-Diff (DD)

Female Dummy×Year	0.0518*** (0.00)
Female Dummy	-0.870*** (0.06)
Time trend	0.0852*** (0.01)
Constant	4.235*** (0.05)
Observations	20,266
R-squared	0.167

Around half of these gains would have happened anyway!

Do Parallel Trends Hold (Triple Diff)?

PANEL B: Testing Parallel Trends in the Triple Difference (DDD)

Female Dummy×Year×Bihar dummy	-0.0100 (0.01)
Female Dummy×Year	0.0618*** (0.01)
Female Dummy×Bihar dummy	0.175 (0.11)
Bihar dummy×Year	0.0290** (0.01)
Female dummy	-1.045*** (0.09)
Time trend	0.0562*** (0.01)
Bihar dummy	-0.123 (0.12)
Constant	4.358*** (0.11)
Observations	22,279
R-squared	0.171

Using Jharkhand as an additional control group works!

Results (Triple Difference)

	Dependent variable=Enrolled in or completed grade 9			
	(1)	(2)	(3)	(4)
Treat × Female dummy × Bihar dummy	0.103*** (0.0302)	0.0912*** (0.0294)	0.0525** (0.0252)	0.0523** (0.0253)
Treat × Female dummy	0.0195 (0.0263)	0.0235 (0.0256)	0.0380* (0.0214)	0.0381* (0.0215)
Treat × Bihar dummy	-0.0437** (0.0179)	-0.0418** (0.0177)	-0.0290* (0.0160)	-0.0281* (0.0161)
Female dummy × Bihar dummy	-0.0942*** (0.0233)	-0.0905*** (0.0226)	-0.0686*** (0.0200)	-0.0673*** (0.0201)
Treat	-0.148*** (0.0143)	-0.143*** (0.0142)	-0.138*** (0.0127)	-0.138*** (0.0127)
Female dummy	-0.0915*** (0.0202)	-0.0880*** (0.0196)	-0.0986*** (0.0172)	-0.0994*** (0.0172)
Bihar dummy	0.0115 (0.0163)	-0.0437*** (0.0165)	-0.0247* (0.0146)	-0.0378** (0.0148)
Demographic controls	NO	YES	YES	YES
HH level and literacy controls	NO	NO	YES	YES
Village level controls	NO	NO	NO	YES
Constant	0.464*** (0.0130)	0.771*** (0.0240)	0.503*** (0.0240)	0.463*** (0.0393)
Observations	30,295	30,295	30,147	30,112
R-squared	0.035	0.088	0.208	0.210

Summary of Results So Far

- Exposure to the Cycle Program increased the age-appropriate secondary school enrollment of girls by 40% (5.2 percentage points on a base of 13%)
- It also reduced the gender gap in age-appropriate secondary school enrollment of girls by 40% (initial gender gap was $\sim 13\%$, with boys having a base enrollment rate of 26%)
 - ▣ No significant heterogeneity by demographic variables
- But there can still be other confounding factors (like differential returns to education for girls in Bihar)
 - ▣ What can we say about the mechanism of impact?

Sketch of Mechanism of Impact

Cost/Benefit

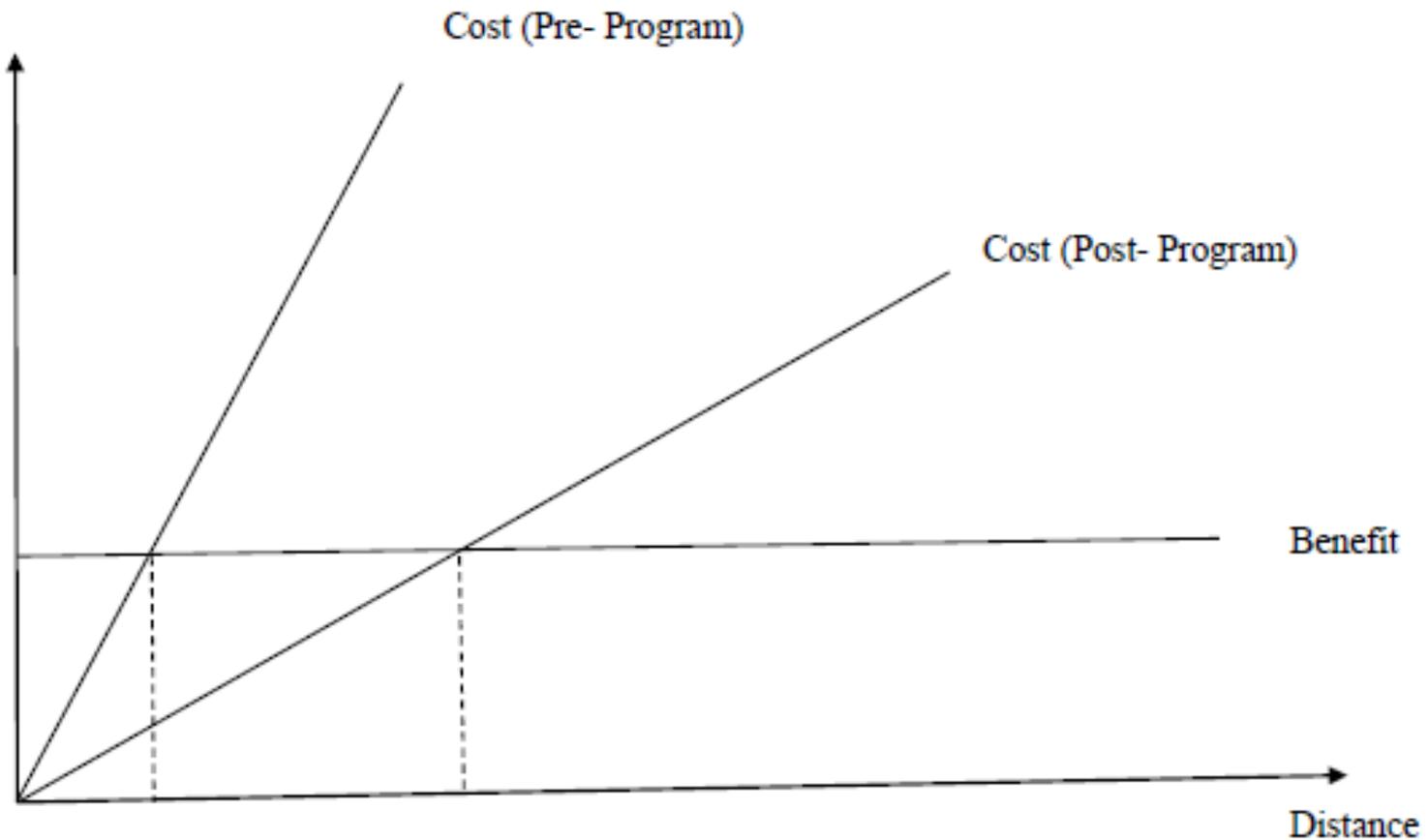
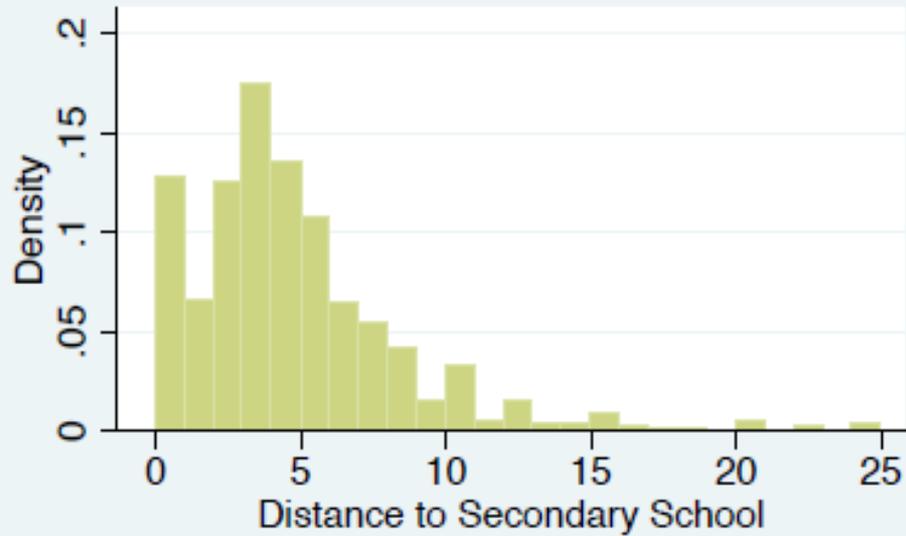


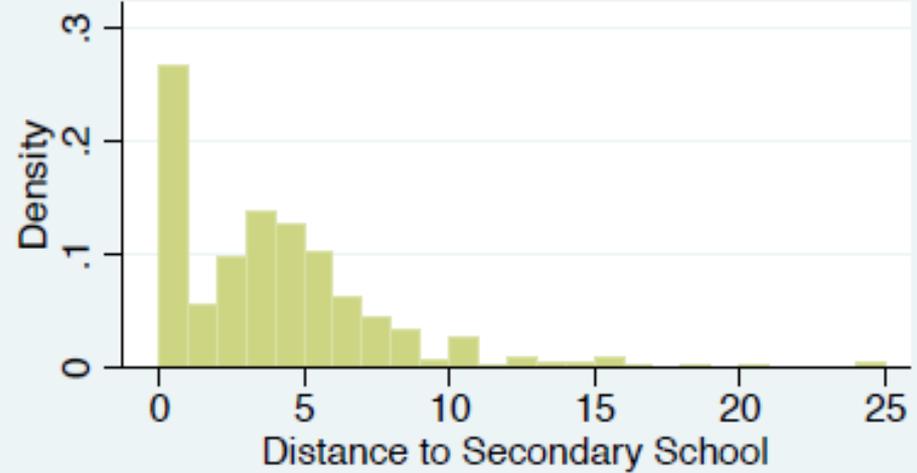
Figure 2: Distribution of Villages by Distance to Secondary School

Bihar

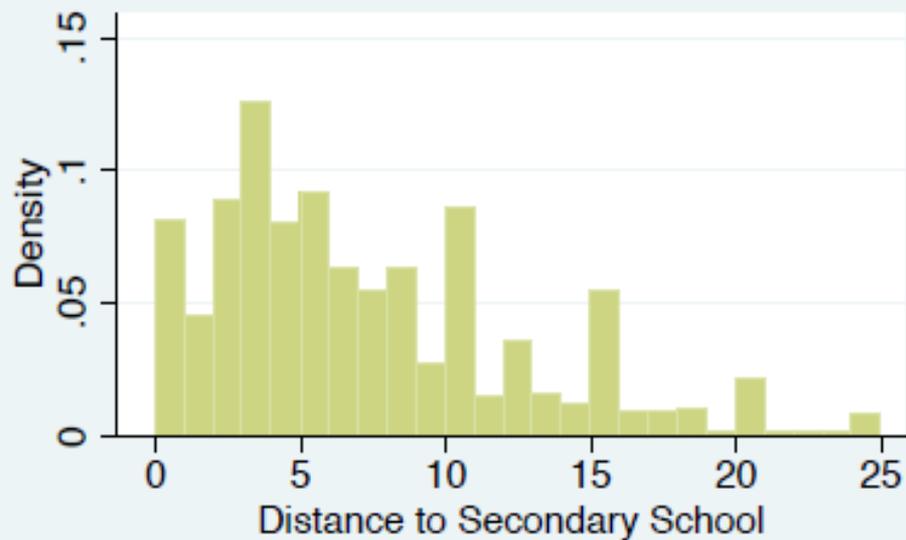


Bihar

Population Weighted

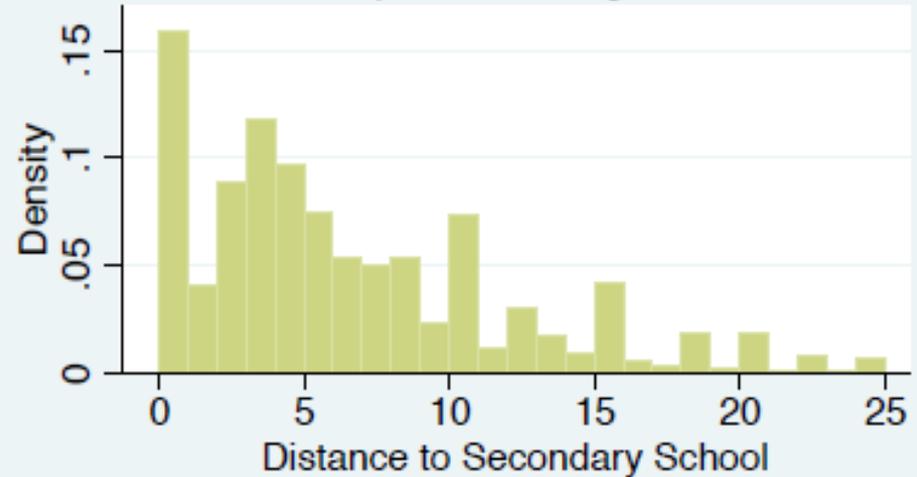


Jharkhand



Jharkhand

Population Weighted

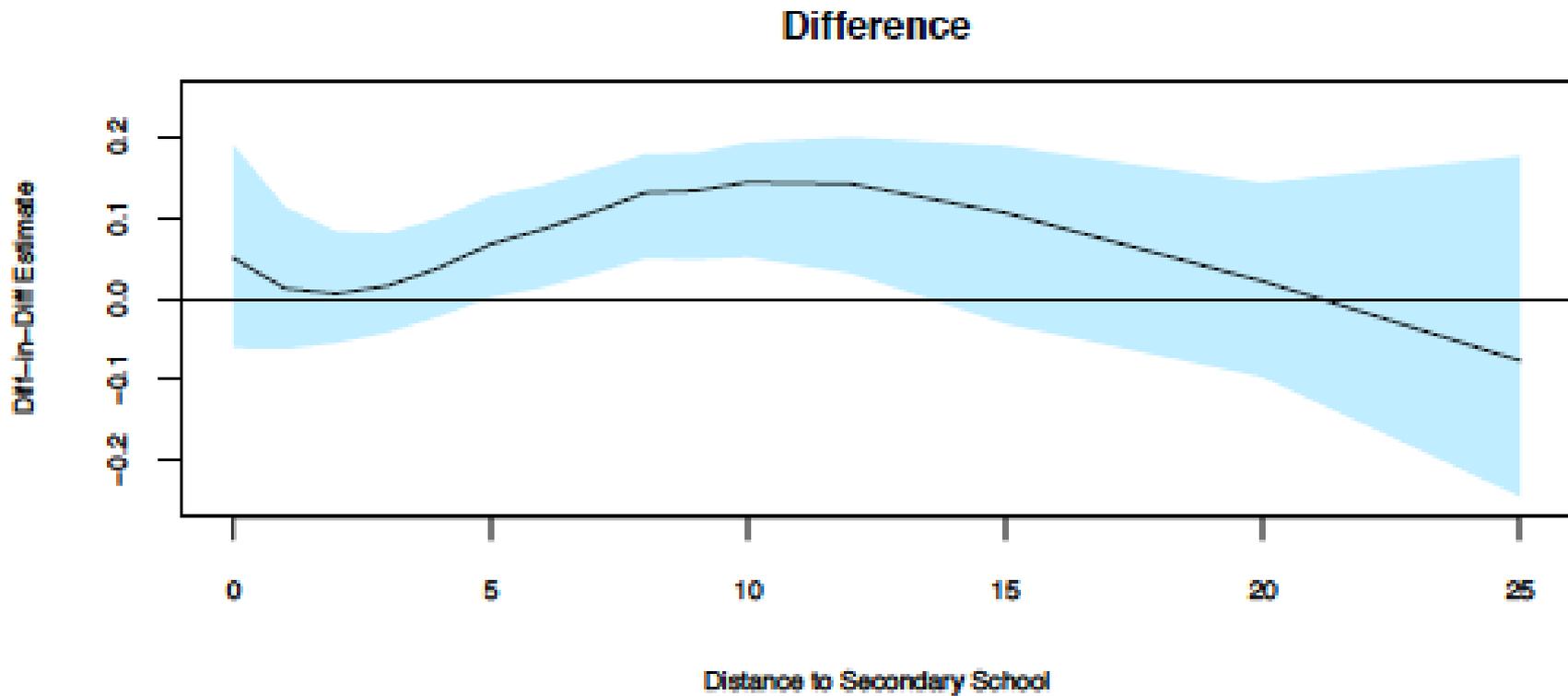


Quadruple Difference

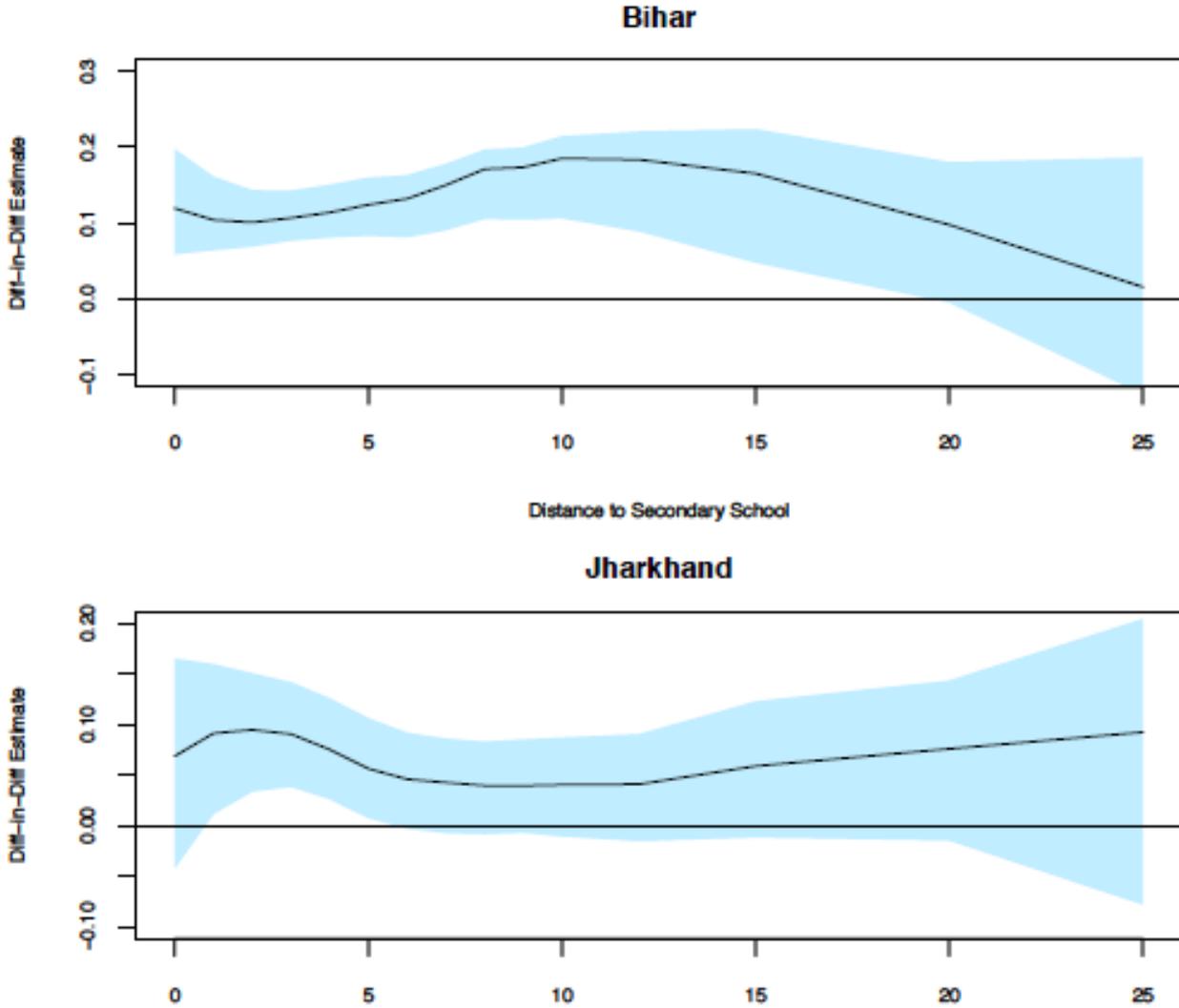
Mechanism of Impact - Quadruple Difference (Triple Difference broken down into cases where distance to secondary school was greater than 3km versus less than 3km)

	(1)	(2)	(3)	(4)
Treat*Female dummy*Bihar dummy*SS is Far	0.0940 (0.0578)	0.0875 (0.0560)	0.0898* (0.0503)	0.0882* (0.0502)
Treat*Female dummy*Long distance	-0.0788 (0.0496)	-0.0803* (0.0480)	-0.0745* (0.0427)	-0.0733* (0.0426)
Treat*Female dummy*Bihar	0.0426 (0.0410)	0.0338 (0.0394)	-0.00504 (0.0376)	-0.00420 (0.0376)
Demographic Controls	NO	YES	YES	YES
Household Asset & Literacy Controls	NO	NO	YES	YES
Village-Level Controls	NO	NO	NO	YES
Observations	30295	30295	30147	30112
R-squared	0.039	0.091	0.209	0.210

Triple Difference by Distance



Double Difference by Distance



Robustness (1)

- Could other factors generate the same pattern that we saw in the previous picture?
 - ▣ Unfortunately (for us) – yes!
 - ▣ Improvements in roads and law and order could also have a differential positive impact on girls **as an increasing function of distance to school**
- So we conduct a placebo test – by looking at the triple-difference estimate of enrollment for 8th standard girls
 - ▣ Just 1 year younger, but not eligible for cycle
 - ▣ We find no differential impact in the 8th standard
- Suggests that the cycle program was the key factor for the effects we find and that our results are causal estimates of its impact
 - ▣ But better roads, and improved law and order could be important complements to the cycle program (which may not have had the same effect without these other investments)

Robustness (2)

- We restrict our analysis to just the border districts and find that the estimates are pretty much unchanged
 - ▣ But standard errors are larger (estimates still significant)
 - ▣ Gives us confidence in the main results (that use full sample from Bihar and Jharkhand)
 - ▣ Note that triple difference estimates need large data sets to be viable (Duflo 2001)
 - ▣ Also, robust to clustering at the district level
- Final concern could be intra-household spillovers
 - ▣ What if boys dropped out of school and did more HH chores because sisters got cycles? This would bias our estimates upwards
 - ▣ Unlikely given patriarchal Bihar (other studies find *positive* spillovers)
 - ▣ But we plot the single difference by gender by distance and find an inverted U for girls and no such pattern for boys

More on Mechanisms

- In looking at mechanisms, we may care about whether the ‘treated’ HH actually received the bicycle!
- Asset questions in DLHS include bicycle ownership
 - ▣ But it does not have ‘number’ of cycles (hence low-powered)
 - ▣ So the triple difference is positive but not significant
- So we rely on Ghatak, Kumar, and Mitra (2013) to confirm that implementation of the program was remarkably effective and that 97% of eligible beneficiaries received the benefit
- Finally, we look at the stated reasons for drop-out among the older cohorts and find that 7.6% say that it was because of distance/transport
 - ▣ Thus, our estimated treatment effects of a 5.2 percentage point increase in enrollment is in the correct ball park

Academic Outcomes (10th Standard)

Dependent Variable	Log (Number of Candidates who Appeared for the 10th Grade Exam - Observation at the School Level)	Log (Number of Candidates who Passed the 10th Grade Exam - Observation at the School Level)
	(1)	(2)
Panel B: Triple Difference (DDD) Estimate of Exposure to Cycle Program		
Bihar Dummy×Female×Post	0.0946** (0.0399)	0.00103 (0.0449)
Female×Bihar Dummy	-0.230*** (0.0760)	-0.183** (0.0776)
Bihar×Post	0.440*** (0.0510)	0.348*** (0.0527)
Female×Post	0.209*** (0.0320)	0.214*** (0.0334)
Female Dummy	-0.661*** (0.0665)	-0.732*** (0.0681)
Observations	45564	45215
R-squared	0.162	0.144

Cost Effectiveness

- Natural comparison is with the common policy (around the world) of conditional cash transfers to HH to keep girls enrolled in school
- A conditional girls scholarship program (for class 6-8) in Pakistan was found to have a significant positive impact on enrollment (also a triple difference estimate)
 - ▣ Program cost \$3/month and increased enrollment by 9% (4 percentage points on a base of 43%)
- Cycle program cost < \$1/month (assuming cycle lasts 4 years) and increased enrollment by 40% (5.2 pp. on base of 13%)
- Thus the Cycle program both cost considerably less and was more effective (both absolute and especially relative effects)
- These results (contrast with Das et al 2013) make it a good setting to think about when in-kind benefits may be better than cash

Why May the Cycle Have Done Better Than A Conditional Cash Transfer?

- Cycle reduced the daily cost of going to school (unlike cash)
- Cycle was NOT infra-marginal to HH spending (and it was difficult to sell the cycle and monetize it – social stigma, price penalty)
- But if the cycle was the key to helping girls go to school, then presumably a HH could have used a CCT to buy cycles on their own
- May not happen for two reasons:
 - ▣ Credit constraints
 - ▣ Intra-household bargaining
- So, the cycle helps the transfer ‘stick’ to the targeted girl
- A further point is that the coordinated provision of cycles most likely generated large externalities (safety in groups, social norms)
- Finally, could have contributed to female empowerment (Basu 2006)

Conclusions and Policy Implications

- Estimates of the impact of the Bihar Cycle Program suggest that it increased girls age-appropriate enrollment in secondary schools by 5 percentage points
 - ▣ On a base of ~13%, this is a 40% increase in enrollment
 - ▣ The policy also reduced the gender gap in enrollment by ~40%
- The program had a greater impact for girls who lived further away from a secondary school, suggesting that a key mechanism for program impact was the reduction in the ‘distance cost’ of school attendance for girls due to the cycle
- From a policy perspective, it is worth highlighting that we are not evaluating a small pilot program but a scaled up “as is” program in a state of 100 million people – with historically weak governance
- Suggests that this may be a scalable policy for improving school access in many other low-income settings
- But, no impact on learning outcomes (consistent with global CCT literature)
 - ▣ This is the next area for policy to focus on – worth highlighting that GoB now offers an additional cash reward for girls passing in Division I or better

Concluding Thoughts

"Investment in girls' education may well be the highest-return investment available in the developing world."

Lawrence H. Summers (former Chief Economist of the World Bank)

"I think the bicycle has done more to emancipate women than anything else in the world."

Susan B. Anthony (19th century leader of US women's suffrage movement)