CASTE PEER EFFECTS ON STUDENT PERFORMANCE
Evidence from Indian Schools

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Motivation

- Mixing individuals from different socioeconomic backgrounds in education a contentious issue.
  - METCO and Busing in the USA.
- Indian counterpart: Reservation policies.
  - Quotas for Scheduled Castes and Scheduled Tribes in educational institutes.
- Most recent: Right to Free and Compulsory Education Act (2009)
  - Minimum of 25% reserved seats for children of economically weaker and socially disadvantaged groups in all primary unaided private schools.

Motivation ...

- Reopened debates around reservation and its inefficiencies.
- Powerful private school lobbies filed a case in the Supreme Court, questioning the constitutional validity of the act.
- Surveys brought out the apprehensions of parents and educators:
  - Parents thought "the quality of education will go down as a result of the reservation".
  - They were "unable to accept that my child and that my domestic help's child will be sitting next to each other in the same classroom".

Research Question

- What are the effects of SC/ST students in the peer group of a student on her performance in class XII board examination?
  - Use a novel administrative dataset on student results from the Central Board of Secondary Education (CBSE);
  - Information on class X and XII board exams scores of students along with other student level information.

Prelude to Results

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- Null effects do not mask heterogeneous effects by ability:
  - Statistically insignificant effects across the ability distributions of both students and peers.
- Results robust to a string of heterogeneity tests and robustness checks.

What are Peer Effects?

- Peer effects encompass nearly any externality in which peers' backgrounds, current behaviour, or outcomes affect an individual's own outcome.
  - Market-based or price-based effects are excluded.
- Peer effects are ubiquitous
  - Test scores, career choice, consumption, crime, drinking behaviour, teenage pregnancy, physical fitness, etc.

Peer Effects in Education

- Peer effects in education has been of increasing interest to both academics and policy makers in recent years.
- Typically focused on the effect on test scores. These can result from
  - Outcomes of one's peers (Sacerdote 2001, Antecol et al. 2016),
  - Peers' academic background (Carrell et al. 2009, Zimmerman 2003),
  - Peers' racial or gender identity (Hoxby 2000, Hanushek et al. 2009).

Related Literature

- Natural experiments to study peer effects in test scores:
  - Randomly assigned room/dorm mates: Sacerdote (2001), Carrell et al. (2009), Jain and Kapoor (2015);
  - Exogenous movement of people: Angrist and Lang (2004), Hoxby and Weingarth (2005), Imberman et al. (2012), Billings et al. (2014).

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- Panel data sets and repeated cross-sections:
  - Hoxby (2000); Lavy and Schlosser (2011); Carrell and Hoekstra (2010)
  - Study the effects of the background (race, gender, domestic violence) of peers.

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  - Study the effects of the background (race, gender, domestic violence) of peers.
- We add to this literature by looking at race/ethnicity based peer effects in the context of a developing country
  - All-India dataset with student level test scores- rare in the Indian context.
  - Control for ability and past inputs by using past test scores.

Institutional Background

- The Central Board of Secondary Education is the largest national school board in India with an all India presence.
- Over 20,300 schools in India and another 220 schools in 28 countries affiliated to it.
- The board conducts two national level standardized examinations every year: Class X and Class XII.
- Common question papers and grading guidelines across the board.

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- Common question papers and grading guidelines across the board.
- Class XII board examination is a "high-stake" test.
- Arguably the most important examination a student appears for in her school life.

Data

- Novel CBSE results data for Class XII and Class X board exams for three cohorts of students.
  - Studies on educational outcomes in India have suffered because of lack of data on students' test scores (Kingdon, 2007).
- Student level data, extremely detailed.
- Contains information on socioeconomic characteristics of students, including caste status.
- Class XII data matched with class X data: Control for past scores of both the student and her peers.

Data ...

- Three cohorts: Class XII batch of 2014, 2015 and 2016.
- Correspondingly, Class X data for the batches of 2012, 2013 and 2014.
- Sample: School-cohorts which have a strictly positive but below 100% share of SC/ST students.
- Final sample consists of 2,152,475 class XII students studying in 10,127 schools all across India.

Summary Statistics

Total students	2,152,475
Girls	44.13%
Caste	
Scheduled Castes	8.82%
Scheduled Tribes	3.56%
Other Backward Castes	18.50%
General	69.12%
Other attributes	
External board exam	36.56%
Mean Annual family income (INR)	270,372.6
(std. dev)	(898,262.9)
Single child	5.31%
Mean score (out of 500) (std. dev)	
Class XII	328.68
	(82.62)
Class X	347.53
	(73.84)
Mean proportion of SC/ST in peer group	0.1262
(std.dev)	(0.1507)

Identification Strategy

- Main challenge in the identification of peer effect: **Self-selection:**
  - Individuals self select into peer groups, difficult to establish the causal effect
  - Possible contamination by omitted variables which determine the selection into peer groups.

Identification Strategy ...

$$S_{isc} = \beta_0 + \beta_1.Pscst_{sc} + \beta_2.X_{isc} + C_c + sch_s + L_s.c + \varepsilon_{isc}. \quad (1)$$

- S_{isc}: Class XII board exam score of student i in school s in cohort c (standardized).
- $Pscst_{sc}$: Proportion of SC/ST students in class XII in school s in cohort c.
- X_{isc}: Student level controls.
- C_c: Cohort fixed effects.
- sch_s: School fixed effects.
- $L_s.c$: School-wise linear time trends.

Identification Strategy ...

- Identification comes from cohort to cohort variation in peer composition within a school (Hoxby 2000).
  - Achieved from the deviation in the proportion of SC/ST students from the school specific linear trend.
  - Residual variation in proportion of SC/ST students is arguably idiosyncratic (e.g., arising from natural biological variation).
- Estimates are causal as long as time-varying unobservables at the school level follow a linear trend.
- Identification is strengthened by including class X scores of students as a proxy for ability and past inputs into the education production function (Hanushek 1979).
- Standard errors are clustered at the school level.

Effect of Proportion of SC/ST Classmates on Test Scores

	(1)	(2)	(3)
Proportion of SC/ST students	-0.0994***	-0.117**	0.00796
	(0.0362)	(0.0558)	(0.0669)
Class X total score	0.643***	0.607***	0.614***
	(0.00422)	(0.00257)	(0.00259)
Female	0.220***	0.138***	0.135***
	(0.00608)	(0.00229)	(0.00229)
SC	-0.0742***	-0.0597***	-0.0584***
	(0.00444)	(0.00198)	(0.00197)
OBC	-0.156***	-0.0444***	-0.0447***
	(0.00777)	(0.00198)	(0.00192)
ST	-0.113***	-0.0767***	-0.0750***
	(0.0145)	(0.00451)	(0.00445)
Cohort FE	√	√	√
School FE		√	√
School-wise time trend			√
N	2077833	2077810	2077810
R^2	0.452	0.614	0.628

Effect of Proportion of SC/ST Classmates ...

- Precisely estimated coefficient: can reject modest sized estimates between 0.12 and 0.14 standard deviations.
- Other coefficients are large and always statistically significant.
- Peer effect coefficient is only 1.3% of the coefficient on class X score.
- The null effect result is in line with other studies which look at the peer effects of minority students (Angrist and Lang, 2004; Hoxby and Weingarth, 2005).

Heterogeneity by Caste and Gender

	(1) SC/ST	(2) OBC	(3) General	(4) Girls	(5) Boys
Proportion of SC/ST students	-0.0633	-0.0473	0.0288	0.00300	0.0149
	(0.0943)	(0.109)	(0.0766)	(0.0824)	(0.0809)
Class X total score	0.545***	0.629***	0.621***	0.585***	0.633***
	(0.00467)	(0.00359)	(0.00277)	(0.00300)	(0.00295)
Female	0.129***	0.161***	0.128***		
	(0.00451)	(0.00372)	(0.00243)		
SC				-0.0613***	-0.0575***
				(0.00254)	(0.00278)
OBC				-0.0326***	-0.0505***
				(0.00236)	(0.00235)
ST				-0.0626***	-0.0858***
				(0.00552)	(0.00559)
Cohort FE	√	√	√	√	√
School FE	√	√	√	√	√
School-wise linear trend	√	√	√	√	√
N	256564	382780	1437301	921765	1155931
R^2	0.674	0.622	0.632	0.637	0.633

Heterogeneity by Income Quartiles

	(1) Quartile 1	(2) Quartile 2	(3) Quartile 3	(4) Quartile 4
Proportion of SC/ST students	0.112	0.0190	0.0222	-0.143
	(0.0978)	(0.0975)	(0.0993)	(0.103)
Class X total score	0.630***	0.618***	0.610***	0.603***
	(0.00356)	(0.00340)	(0.00316)	(0.00360)
Female	0.162***	0.154***	0.129***	0.0980***
	(0.00354)	(0.00331)	(0.00313)	(0.00301)
SC	-0.0431***	-0.0549***	-0.0685***	-0.0824***
	(0.00302)	(0.00358)	(0.00381)	(0.00430)
OBC	-0.0337***	-0.0404***	-0.0456***	-0.0460***
	(0.00298)	(0.00327)	(0.00302)	(0.00326)
ST	-0.0560***	-0.0775***	-0.0710***	-0.0955***
	(0.00714)	(0.00820)	(0.00727)	(0.00681)
Cohort FE	√	√	√	√
School FE	√	√	√	√
School-wise linear trend	√	√	√	√
N	593438	518597	494177	470203
R^2	0.624	0.614	0.628	0.693

Heterogeneity by School Administration

	(1) Private	(2) Public
Proportion of SC/ST students	0.00271	-0.000445
	(0.108)	(0.0829)
Class X total score	0.644***	0.530***
	(0.00300)	(0.00443)
Female	0.145***	0.0861***
	(0.00274)	(0.00352)
SC	-0.0851***	-0.0465***
	(0.00305)	(0.00250)
OBC	-0.0564***	0.000506
	(0.00233)	(0.00270)
ST	-0.119***	-0.0392***
	(0.00651)	(0.00554)
Cohort FE	√	√
School FE	√	√
School-wise linear trend	√	√
N	1381105	695550
R^2	0.630	0.628

Robustness I: Inclusion of Quadratic Term and Mean Controls

	(1)	(2)
Proportion of SC/ST students	0.00741	-0.0811
	(0.117)	(0.0628)
(Proportion of SC/ST students) sq	0.00111	
	(0.197)	
Class X total score	0.614***	0.614***
	(0.00259)	(0.00261)
Female	0.135***	0.135***
	(0.00229)	(0.00231)
SC	-0.0584***	-0.0568***
	(0.00197)	(0.00198)
OBC	-0.0447***	-0.0441***
	(0.00192)	(0.00189)
ST	-0.0750***	-0.0734***
	(0.00444)	(0.00445)
Mean controls		√
Cohort FE	√	√
School FE	√	√
School-wise time trend	√	√
N	2077810	2047950
R^2	0.628	0.628

Robustness II: Different Stream Choices of Students

	(1) Science	(2) Commerce	(3) Arts
Proportion of SC/ST students	0.0375	-0.103	-0.0811
	(0.0811)	(0.110)	(0.166)
Class X total score	0.746***	0.728***	0.754***
	(0.00306)	(0.00320)	(0.00884)
Female	0.0672***	0.102***	0.103***
	(0.00282)	(0.00336)	(0.00672)
SC	-0.0465***	-0.0853***	-0.0359***
	(0.00272)	(0.00393)	(0.00352)
OBC	-0.0276***	-0.0512***	0.0242***
	(0.00236)	(0.00308)	(0.00534)
ST	-0.0799***	-0.144***	0.0142
	(0.00473)	(0.00769)	(0.0107)
Cohort FE	√	√	√
School FE	√	√	√
School-wise linear trend	√	√	√
N	994354	591334	287246
R^2	0.668	0.643	0.710

Robustness III: School Change Status of Students

	(1) Changed schools after class X	(2) Did not change schools after class X
Proportion of SC/ST students	-0.0694	0.0268
	(0.113)	(0.0721)
Class X total score	0.579***	0.666***
	(0.00423)	(0.00288)
Female	0.165***	0.112***
	(0.00410)	(0.00213)
SC	-0.0815***	-0.0445***
	(0.00402)	(0.00202)
OBC	-0.0496***	-0.0315***
	(0.00337)	(0.00191)
ST	-0.0982***	-0.0487***
	(0.00766)	(0.00464)
Cohort FE	√	√
School FE	√	√
School-wise linear trend	√	√
N	624080	1453469
R^2	0.600	0.668

Caste Peer Effects and Ability ...

	(1) Quartile 1	(2) Quartile 2	(3) Quartile 3	(4) Quartile 4
Proportion of SC/ST students	-0.130	-0.0412	0.0923	-0.0301
	(0.114)	(0.0966)	(0.0895)	(0.0875)
Class X total score	0.654***	0.562***	0.600***	0.939***
	(0.00735)	(0.00586)	(0.00504)	(0.00640)
Female	0.150***	0.194***	0.147***	0.0301***
	(0.00400)	(0.00328)	(0.00305)	(0.00275)
Cohort FE	√	√	√	√
School FE	√	√	√	√
School-wise linear trend	√	√	√	√
N	535134	523533	513771	504159
R^2	0.727	0.485	0.461	0.791

Non-linear Effects by Ability ...

	(1) Full sample	(2) Quartile 1	(3) Quartile 2	(4) Quartile 3	(5) Quartile 4
Proportion of SC/ST students in Q1	0.0145	0.0544	0.0210	0.0263	-0.0193
	(0.0234)	(0.0523)	(0.0340)	(0.0294)	(0.0312)
Proportion of SC/ST students in Q2	-0.00144	-0.0579	-0.0781	0.0726	0.0156
	(0.0397)	(0.0776)	(0.0586)	(0.0516)	(0.0530)
Proportion of SC/ST students in Q3	-0.0240	0.0294	-0.103*	-0.0676	-0.00479
	(0.0421)	(0.0729)	(0.0559)	(0.0543)	(0.0577)
Proportion of SC/ST students in Q4	-0.0147	0.0128	0.0155	-0.0822*	-0.105*
	(0.0345)	(0.0446)	(0.0587)	(0.0421)	(0.0567)
Class X total score	0.612***	0.652***	0.553***	0.602***	0.931***
	(0.00272)	(0.00800)	(0.00598)	(0.00534)	(0.00695)
Cohort FE	√	√	√	√	√
School FE	√	√	√	√	√
School-wise time trend	√	√	√	√	√
N	1742711	396620	455035	461668	428430
R^2	0.609	0.715	0.477	0.454	0.780

Conclusion

- The proportion of SC/ST students in the cohort peers of a student does not have any statistically significant effect on her test scores.
- Robust and precisely estimated null effects: can reject modestly sized estimates between 0.12σ and 0.14σ.
- Results hold separately for all caste categories, both genders, all four income quartiles, both public and private schools and for all students in various streams in class XII.
- Also holds for students who changed schools after class X and for those who did not.
- Results do not mask heterogeneous effects by ability.


Thank
you!