Identity and Learning: a study on the effect of student teacher gender interaction on student's learning

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Motivation

- Issue of pairing teachers and students from the same social group
 - Such pairing does not have much impact (Ehrenberg et. al. 1995)
 - There is positive impact on learning outcome (Fairle 2014, Dee, 2004)
- Three kinds of explanations regarding the effects of pairing of teachers and students (Dee, 2014)
 - Active teacher effect
 - Specific favouritism shown by teacher in terms of interaction, coverage of material etc. with students from the same social group.
 - Role model effect
 - The presence of a teacher from the same social group raises a student's academic motivation and expectation
 - Stereotype threats
 - Importance of academic identification in the form of valuing self-worth in academic achievement

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Evidences of race-based stereotype threats

Objectives

- 1. To explore the teacher-student identity interaction in terms of gender identity within an optimizing matching framework.
- 2. Rather than explaining the effect of student-teacher pairing on gender lines on exogenous cultural traits such as role model or stereotype, we explain this in terms of an endogenous sorting mechanism in terms of school type (private/public) and teacher's and student's quality.
- 3. Validating the results from our theoretical model with empirical data using YLS data set from Andhra Pradesh.

Results

- 1. There is quality sorting into private and public schools along the gender lines for both the teachers and students
- 2. Top quality female teachers join urban private schools while top quality male teachers are randomly distributed across public schools
- 3. Only good quality female students attend private schools
- 4. In private schools female teachers have positive significant effect on all students, but the effect is stronger for female students.

Model - Schools

- Two types of schools private and government. Each school employs one teacher
- ▶ The schools are distributed over the locations [0, 1] with a government school at each location.
- The existence of a private school at a particular location depends on two things:
 - 1. There must be a teacher who is willing to teach in the private school at that location at wage w_{p}
 - 2. There must be students in that particular location who are willing to get enrolled in a private school paying the fee t.
- Government school teachers are better paid $(w_g > w_p)$.
- The schools do not face any capacity constraint.
- All schools try to recruit better quality teachers
- ▶ Government allocates recruited teachers randomly across [0, 1], while in private sector teachers can select the location.

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Teachers

- Teachers are of two broad categories- male and female
- \blacktriangleright Within each category there are teachers of different qualities, $q\in[0,1]$
- ▶ For each quality, there is exactly one male and one female teachers
- The pay-offs from employment in a school depend on the distance traveled by the teacher
- The cost of traveling to a distant school is higher for female teachers than male ones

$$u_i(w,x) = w - \theta_i(1-x)$$

where $\theta_F = 1$ and $\theta_M = \theta < 1$.

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Teacher's location and pay-off

- ▶ We assume that if a teacher accepts a job in government schools, she is randomly allocated to any government school in the interval [0, 1]
- ▶ For the private school however, a teacher can select its location.
- The expected pay-off from a government job is

$$\Pi_g^i = w_g - \frac{\theta_i}{2}$$

for i = F, M.

On the other hand, if a teacher gets a job in a private school located at x, her pay-off is

$$\Pi_p^i = w_p - \theta_i \left(1 - x\right)$$

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Students

- ▶ At each location, there are students of two categories female and male
- \blacktriangleright Within each category, there are students of different abilities with $a \in [0,1]$
- At each location there are one male and one female students with a particular ability
- A student must choose a school in her location (prohibitive travel cost)
- The return from education for a student depends on her future productivity, which in turn depends on knowledge acquired at school and his ability
- ▶ For the employers, the knowledge is verifiable but ability is not.

Knowledge Production and Return From Education

Knowledge production function

k = aq

for student with ability a when matched with teacher of quality q.

- The return from education for a student depends on her future productivity, which in turn depends on knowledge acquired at school (k) and his ability (a).
- Employers observe k and the type of school (private or government) the child goes to, but not a and q separately. Wage offer depends on k and the average ability of the children going to a particular type of school.

Return From Education contd.

▶ We assume that the expected net return for a child with knowledge *k* from private schooling is

$$y_{p}(k) = \beta Ak - t$$

and from government school is

$$y_g(k) = Ak$$

where β is relative premium from private schooling.

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Parametric Restrictions

Al $w_g > rac{1}{2}, \ \theta < w_p < 1$

A1 makes sure that the female teachers find it remunerative to accept government jobs. The bounds on w_p generate voluntary unemployment for female teachers while full-employment for male teachers.

A2
$$w_g - w_p < \frac{1}{2}$$

A female teacher prefers a job in a private school of her most preferred location (x = 1) over a government job.

A3
$$w_g - w_p > \frac{\theta}{2}$$

 A male teacher always prefers a government job over a private job.

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A4
$$\frac{t}{A} \leq x_0 - \bar{q}^g$$

Teacher - School matching : Male

A male teacher accepts a government job over an offer from a private school at location x, if and only if

$$w_g - rac{ heta}{2} \ge w_p - heta \left(1 - x
ight) \Leftrightarrow x \le rac{w_g - w_p}{ heta} + rac{1}{2}$$



Figure: Quality-wise distribution of male teachers among government and private schools



Teacher - School matching : Female

A female teacher accepts an offer from a private school at location over a government job, if and only if

$$w_g - rac{1}{2} \leq w_
ho - (1-x) \Leftrightarrow x \geq w_g - w_
ho + rac{1}{2} = x_0$$



 $\label{eq:Figure: Quality-wise distribution of female teachers among government and private schools$

- ► Notice that all teachers both male and female prefer government jobs over jobs in private schools located at x ≤ x₀.
- ► However, since the total number of government schools is of measure 1 and 1 - x₀ of these jobs are already filled up by top quality male teachers, the rest will be shared equally between male and female teachers moving downwards in the quality ladder from x₀.
- ▶ Thus, q_F ∈ [^{x0}₂, x₀] female teachers and q_M ∈ [^{x0}₂, 1] male teachers will accept government jobs.

- Once government jobs are filled-up, the rest would accept employment in private schools if the net pay-off exceeds the reservation utility.
- ► For female teachers, joining a private school at location *x* is better than remaining unemployed if and only if

$$w_p - (1 - x) \ge 0 \Leftrightarrow x \ge 1 - w_p = x_1$$

► For the male teachers, the condition for joining a private school at location x is

$$w_{p}- heta\left(1-x
ight)\geq0\Leftrightarrow x\geq1-rac{w_{p}}{ heta}$$

► A1 ensures that male teachers accept employment at the worst possible private school location while female teachers will prefer unemployment to a sufficiently bad location denoted by *x*₁

Observations on teacher quality

- In government schools, average male teacher quality exceeds average female teacher quality.
- Average male teacher quality in government schools exceeds that in private schools.
- The average quality of the government school teacher is $\bar{q}^g = \left(\frac{2+x_0^2}{4}\right) < x_0.$

Teacher quality in private schools



Figure 3: Teacher quality in private schools at different locations

School choice for students

- While the whole future earning of a boy accrues to the family, only a fraction, α, of that the family can retain for a girl.
- ► A boy with of ability a located at x ∈ (x₀, 1] is sent to a private school if and only if

$$\beta Aax - t \ge Aa\bar{q}^{g} \Leftrightarrow a \ge \frac{\frac{t}{A}}{\beta x - \bar{q}^{g}} = a_{1}^{m}(x, \beta)$$

where β is perceived private school premium.

▶ For a girl at the same location with same ability this becomes

$$a \geq rac{rac{t}{lpha A}}{eta x - ar{q}^g} = a_1^f(x,eta) > a_1^m(x,eta)$$

At any location, the average ability of the girls going to private school is more than that of the boys.

Equilibrium

- Since the ability of the students going to private and government schools at any location depends on β, the average abilities of students over all locations going to private and government schools, a^p and a^g, as functions of β.
- \blacktriangleright The equilibrium is a fixed point $\beta^*>1$ such that

$$\beta^* = \frac{\bar{a}^p\left(\beta^*\right)}{\bar{a}^g\left(\beta^*\right)}$$

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Teacher - Student matching



Teachers in private schools

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Main Results

Proposition

In equilibrium, there is voluntary as well as involuntary unemployment among teachers. The extent of involuntary unemployment is higher among male teachers than among female teachers.

Proposition

The average ability of students in private schools exceed the average ability of students in government schools across categories.

Proposition

The average performance of girls exceeds that of boys in private schools.

Main Results contd.

Proposition

Both boys and girls in private schools perform better on average when matched with a female teacher than when matched with a male teacher.

Proposition

Among the girls and boys who are sent to private school a girl is expected to perform generally better than a boy with the same ability.

Proposition

The expected performances of boys and girls of any given ability are lower under male teachers than under female teachers. However, the extent of loss is lower for the boys than for the girls.

Intuition

- Private schools in teachers' preferred locations get best quality female teachers given the random allocation of government teachers across locations and higher opportunity cost of travelling for females.
- Households' effective cost of sending the girls to private schools is higher than the boys and therefore only the smartest girls are sent to private schools.
- Given that the marginal effect of teacher quality is higher for higher ability students, the matching between high ability girls and high quality female teacher in private schools leads to better performance for the girls on average.

Empirical Validation

- 1. Hypothesis 1 : The average quality of female teachers is higher than that of their male counterpart in private schools.
- 2. Hypothesis 2 : The average performance of female students is higher than the male students in private schools.
- 3. Hypothesis 3: The interaction effect of female (male) student female (male) teachers would be negative (positive).

- ▶ Young Lives Study in Andhra Pradesh between 2002-2011.
- We use data of the cohort of children born between January 2001 and June 2002.
- The sample included 952 children across 247 schools both vernacular and English medium.

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Model specification

We estimate the model

$$Y_{i} = \alpha_{0} + \alpha_{1} D_{i}^{MS} + \alpha_{2} D_{i}^{MT} + \alpha_{3} \left(D_{i}^{MS} * D_{i}^{MT} \right) + \beta X_{i}^{S} + \gamma X_{i}^{T} + \epsilon_{i}$$

- Y_i = Standardised z score in math test of the student *i*
- D_i^{MS} = Male dummy of student *i*
- D_i^{MT} = Male teacher dummy of student *i*
- X_i^S = Control for student background information
- X_i^T = Control for teacher background information

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Teacher academic profile

	Matriculation	HS	Bachelor	Masters	Other	Total
Male	9(2.24)	68(16.92)	239(59.45)	86(21.39)	0(0)	402(100)
Female	19(10.38)	62(33.88)	73(39.89)	29(15.85)	0(0)	183(100)
Total	28(4.79)	130(22.22)	312(53.33)	115(19.66)	0(0)	585(100)

Table 2: Academic degree of teachers across gender in public schools

Table 1: Academic degree of teachers across gender in private schools

	Matriculation	HS	Bachelor	Masters	Other	Total
Male	0(0)	12(8.89)	83(61.48)	40 (29.63)	0	135(100)
Female	1(.43)	44(18.97)	165(71.12)	21(9.05)	1(0.43)	232 (100)
Total	1(0.27)	56(15.26)	248(67.57)	61(16.62)	1(0.27)	367(100)

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Teacher professional degree

	None	Diploma	B.Ed./TPT/HPT	M.Ed.	Other	Total
Male	34(25.19)	10(7.41)	86(63.7)	0	5(3.7)	135(100)
Female	102(43.97)	26(11.21)	98(42.24)	0	6(2.59)	232(100)
Total	136(37.06)	36(9.81)	184(50.14)	0	11(3.0)	367(100)

Table 4: Professional degree of teachers across gender in public schools

	None	Diploma	B.Ed./TPT/HPT	M.Ed.	Other	Total
Male	40(9.95)	116(28.86)	241(59.95)	5(1.24)	0	402(100)
Female	61(33.33)	47(25.68)	74(40.44)	0(0)	1(0.55)	183
Total	101(17.26)	163(27.86)	315(53.85)	5(.85)	1(.17)	585(100)

Teacher job status

	Permanent	Temporary	Total
Female	52(54.17)	180(66.42)	232 (63.22)
Male	44(45.83)	91(33.58)	135(36.78)
Total	96(100)	271(100)	367(100)

Table 5: Job status of teachers in private schools

Table 6: Job status of teachers in public schools

Permanent	Temporary	Total
79(20.1)	104(54.17)	183(31.28)
314(79.90)	88(45.83)	402(68.72)
393(100)	192(100)	585(100)
	Permanent 79(20.1) 314(79.90) 393(100)	Permanent Temporary 79(20.1) 104(54.17) 314(79.90) 88(45.83) 393(100) 192(100)

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Regression results

Table: Dependent variable: Math Z Score

	ALL	GOVT	PVT
	z_math	z_math	z_math
female	0.0125	-0.154	0.240*
	(0.14)	(-1.05)	(2.19)
mteacher_female	-0.160	-0.435***	0.364*
	(-1.66)	(-3.34)	(2.36)
Interaction	-0.0174	-0.303	0.496**
	(-0.14)	(-1.74)	(2.68)

Controls: Household size, Wealth Index, Household head's Education, Bad Shocks, Household Support, Region, Normalized Past PPVT score, Normalized Past Cognitive score, Math Teacher Highest Qualification, Math Teacher Experience, English Medium, Sector(Rural/Urban)

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Table: Dependent variable: Math Z Score

Dep var: Math Z Score	RURAL	URBAN	RURAL-GOVT	RURAL-PVT	Urban-Govt	Urban-Pvt
	z_math	z_math	z_math	z_math	z_math	z_math
female	-0.213	0.379*	-0.207	-0.0116	0.781	0.365**
	(-1.83)	(2.58)	(-1.38)	(-0.06)	(0.90)	(2.62)
mteacher_female	-0.359**	0.378	-0.476***	0.0494	1.804	0.519*
	(-3.24)	(1.53)	(-3.60)	(0.22)	(1.10)	(2.14)
Interaction	-0.253	0.359	-0.317	0.0713	2.620	0.639
	(-1.78)	(1.08)	(-1.78)	(0.28)	(0.67)	(1.86)

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Concluding Comments

- We explain the interaction effect between students and teachers in terms of gender based quality sorting of both students and teachers across public and private schools.
- Our explanation is driven by two sets of parameters that creates the difference between the incentive structure for both male and female.
- ► For teachers, the crucial difference lies in different opportunity costs faced men and women teachers while attending distantly located schools.
- ► For students, the difference comes from the differences in their families' claim on their return from human capital investment.
- Our theory predicts that the interaction effect will be different for public and private schools which is confirmed by our empirical result.
- Such differential interaction effect across public and private schools also suggests that the result could not have been driven by any cultural trait based explanations.

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