城市经济学课程论文

EFFECTS OF TEACHERS' GENDER ON STUDENTS' ACADEMIC ACHIEVEMENTS: AN EMPIRICAL ANALYSIS BASED ON CEPS DATA

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EFFECTS OF TEACHERS' GENDER ON STUDENTS' ACADEMIC ACHIEVEMENTS: AN EMPIRICAL ANALYSIS BASED ON CEPS DATA

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This paper examines the effects of teachers' gender on the academic performance of junior high school students in China. By taking students' gender, teachers' gender and the interaction term of this two as explanatory variables in a linear regression model, I find that no difference between female and male teachers in their teaching effectiveness for students in all three subjects - Math, Chinese and English, while the estimated effect of class teachers' gender differs. The findings of this paper carry implications for research, school health and education policy and physical and general education practice.

I. INTRODUCTION

Based on a nationally representative data of middle school students from China, this paper intends to document gender performance gaps among middle school students in China and the role of teachers' gender in either reducing or perpetuating such gaps. Exploiting the fact that middle school students in China are randomly assigned to classes, we then examine the impact of student-teacher gender match on academic performance in each subject area and the effect of the class teachers' gender.

In China, a "class teacher" plays a significant role in the education system. They are primarily responsible for a specific class or grade, overseeing students' academic progress, behavior management, and providing guidance and support throughout their educational journey.

Our results suggest that there is no difference between female and male teachers in their teaching effectiveness for students in all three subjects, while the estimated effect of class teachers' gender differs. Compared to having a male class teacher, having a female class teacher increases male students' average test score by approximately 1.6 points and increases female students' average test score by around 1.2 points. We also find that the female - teacher effect on male students is larger than on female students in a certain sample. The mechanism might be the complementary relationship between female teachers and male students.

II. DATA

The data comes from the baseline wave of China Educational Panel Survey (CEPS) conducted by the National Survey Research Center at Renmin University of China. The CEPS is China's first nationally representative longitudinal survey that aims to track middle school students through their educational progress and later labor market activities throughout their life cycles. The baseline survey of the CEPS adopted a stratified, multistage sampling design with probability proportional to size, randomly selecting approximately 20,000 seventh-grade and ninth-grade students from 438 classes of 112 schools in 28 counties in mainland China during the 2013-2014 academic year.

The CEPS conducted a questionnaire survey to ask students' gender, class teachers' gender, as well as the genders of the teachers for mathematics, Chinese, and English, which allows me to define the key explanatory variable used in this paper. The CEPS also contains detailed information on students' academic performance - the school records on students' mid-term test scores[1] in the following three compulsory subjects: Math, Chinese and English, which together with the average of the scores of these three subjects form the outcome of interest in this paper. Besides, self-reported academic

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[1] The mid-term test scores are standardized in terms of school and grade.

performance indicators at the sixth grade in the primary school are included in the data.[2] Except for students' characteristics, the CEPS collected their family background information, such as parents' education levels, household income levels and number of siblings, which may be important determinants of students' academic performance.

To construct the explanatory variable, I firstly define the dummies standing for "female students" and "female teachers". Then I drop those data with key variables (test scores, students' and teachers' gender) missing and those whose average test score is larger than 100. Finally, the sample used in the analysis includes 18,944 students, comprising of 10,037 grade 7 students and 8,907 grade 9 students.

Table 1 presents the summary statistics of main variables for students in grade 7 and grade 9 of the junior high school.

TABLE 1—SUMMARY STATISTICS OF MAIN VARIABLES

	All students	Grade 7 students	Grade 9 students
Panel A: Student Characteristics			
Average score	70.02	70.02	70.02
Math score	70.02	70.02	70.01
English score	70.02	70.03	70.02
Chinese score	70.02	70.02	70.03
Female (%)	0.488	0.474	0.502
Age	13.51	12.57	14.57
Minority (%)	0.0849	0.0844	0.0855
Agricultural hukou (%)	0.547	0.536	0.560
Migrant (%)	0.178	0.205	0.148
Live on the campus (%)	0.322	0.309	0.337
Difficulty degree of learning in grade6			
Math	2.869	2.865	2.874
English	2.729	2.816	2.629
Chinese	3.157	3.108	3.213
Panel B: Household Characteristics			
Mother's year of education	9.567	9.711	9.404
Mother's education level (%)			
Primary school or below	0.246	0.225	0.269
Middle school	0.411	0.413	0.409
High/technical school	0.213	0.228	0.197
College or above	0.130	0.134	0.125
Father's year of education	10.33	10.44	10.21
Father's education level (%)			
Primary school or below	0.152	0.141	0.165
Middle school	0.442	0.432	0.452
High/technical school	0.251	0.267	0.234
College or above	0.155	0.160	0.149
Household income level (%)			
Low	0.210	0.214	0.205
Middle	0.730	0.727	0.735
High	0.0599	0.0593	0.0607
Number of siblings	0.741	0.745	0.736
Observations	18,944	10,037	8,907

III. EMPIRICAL STRATEGY

To examine the effects of gender of class teachers and math, Chinese and English teachers on students' academic

[2] The CEPS asked students to recall the difficulty degree of learning Math, Chinese and English when they attended the sixth grade in the primary school: very difficult ('1'), difficult ('2'), somewhat difficult ('3'), and not difficult ('4').

achievements, respectively, I conducted three regressions. Firstly, I take class teachers' gender as the explanatory variable and examine its effect on the average test scores of students. Then, I take the gender of teachers for math, Chinese and English as explanatory variables, respectively, and examine their effects on students' test score of each respective subject.

I run the following regression across subjects using the OLS method:

$$Score_{icgs} = \beta_0 + \beta_1 FS_{icgs} + \beta_2 FT_{icgs} + \beta_3 FS_{icgs} \times FT_{icgs} + \beta_4 X_{icgs} + e_{icgs} \#(1)$$

Where $Score_{icgs}$ denotes the mid-term test scores in the three subjects (Math, Chinese and English) and the average of those three for student i in class c of grade g of school s. FS_{icgs} and FT_{icgs} are dummies standing for "female students" and "female teachers", respectively, which are assigned "1" for female and "0" for male. $FS_{icgs} \times FT_{icgs}$ is the interaction term of "female students" and "female teachers". The covariate vector X_{icgs} represents the characteristics that are important determinants of student's academic performance, including student's age, ethnic minority status, agricultural hukou status, whether living on campus, whether being a migrant student and difficulty degree of learning in grade 6[3] as well as parents' education levels, number of siblings and household income level. Class level characteristics such as class size and the share of migrant peers are also included in X_{icgs}[4]. Throughout the analysis, I cluster the standard errors at the school level to allow for heteroskedasticity and arbitrary serial correlation across students within each school.

To overcome the possible effects of class level characteristics on students' test scores, grade-by-school fixed effects (μ_{cgs}) is used. That is:

$$e_{icgs} = \mu_{cgs} + \varepsilon_{icgs} \#(2)$$

Where ε_{icgs} denotes the new error term. Conditioning on the grade-by-school fixed effects, the key explanatory variables should be orthogonal to the error term (ε_{icgs}) and the estimation precision has increased.

The β coefficients are the main coefficients of interest. β_1 captures the difference in mean academic performance between female and male students when they have a male teacher. β_2 captures the value added by having a female teacher, if $\beta_2 > 0$, it indicates that female teacher benefits male students' academic performance. The combined effect of β_2 and β_3 represents the influence of teachers' gender on female students' performance. $\beta_2 + \beta_3$ means that female teachers' instruction enhances female students' performance. β_3 captures the effect of teacher gender on student gender differences. If β_3 is greater than zero, it means that female teachers' instruction has a greater positive effect on female students' performance compared to male students. Conversely, if it is less than zero, the opposite is true.

IV. Main Results

In this section I firstly examine the causal effect of teachers' gender (Math, Chinese, English teachers and the class teacher) on students' standardized mid-term test scores in the three compulsory subjects (Math, Chinese and English) and the average test scores of those three subjects. Then I do robustness checks by using various samples.

A. Effects on Students' Academic Performance

As shown in Table 2, the main effect for "female students" (first row) is positive in all three subjects, indicating that girls significantly outperform boys in these three subjects in male-taught classes. In Chinese, in particular, girls receive a midterm score that is 5.265 higher relative to boys. In contrast, the gender achievement gap in math is small in magnitude.

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[3] The regression of the average test score controls for difficulty degree of learning all three subjects (Math, Chinese and English) in grade 6. The regression of the Math (Chinese, English) score controls for difficulty degree of learning Math (Chinese, English) in grade 6.

[4] Krueger (1999) found that class size has significant effect on students' performance on standardized tests. Hu (2018) found that migrant peers have large and negative effects on the academic performance of local students in China. Thus I take the class fixed effect into consideration.

The estimates on the female teacher dummy variable (second row) are consistently insignificant in all three subjects, indicating that there is no overall difference between female and male teachers in their teaching effectiveness for male students as measured by student test scores. Nevertheless, the estimated effect of class teachers' gender is significant at 1% level, which indicate that having a female class teacher increases male students' average test score by 1.698 points.

The third row displays the estimated coefficient on the interaction term between the gender of the student and the gender of the teacher. This interaction term is the key variable of interest in our study, which measures the extent to which having a female teacher differently affects female and male students. The estimated effect is small and insignificant in all three subjects and the average score, however.

Similarly, the estimated effect of teachers' gender on female students' test score (β_2+β_3) are consistently insignificant in all three subjects, indicating that there is no overall difference between female and male teachers in their teaching effectiveness for female students as measured by student test scores. However, the estimated effect of class teachers' gender is significant for all grade 7 and grade 9 female students, which indicate that having a female class teacher increases female students' average test score by 1.246 points.

To sum up, we find no difference between female and male teachers in their teaching effectiveness for students in all three subjects, while the estimated effect of class teachers' gender differs. Compared to having a male class teacher, having a female class teacher increases male students' average test score by approximately 1.6 points and increases female students' average test score by around 1.2 points.

TABLE 2—EFFECTS OF TEACHERS' GENDER ON STUDENTS' MID-TERM TEST SCORES

	All students	Grade 7 students	Grade 9 students
Panel A: Average score			
female students (β_1)	4.446***	4.431***	4.465***
	(0.232)	(0.286)	(0.314)
female teachers (β_2)	1.698***	1.661***	1.629**
	(0.503)	(0.609)	(0.630)
female students × female teachers (β_3)	-0.451	-0.442	-0.502
	(0.283)	(0.368)	(0.409)
β_2+β_3	1.246**	1.219**	1.126*
	(0.485)	(0.563)	(0.614)
Observations	17588.000	9377.000	8211.000
R^2	0.212	0.235	0.191
Panel B: Math score			
female students (β_1)	1.786***	2.036***	1.518***
	(0.382)	(0.545)	(0.509)
female teachers (β_2)	0.418	0.167	0.797
	(0.705)	(0.730)	(1.234)
female students × female teachers (β_3)	0.592	0.328	0.827
	(0.463)	(0.649)	(0.633)
β_2+β_3	1.010	0.495	1.624
	(0.667)	(0.842)	(1.074)
Observations	12781.000	6684.000	6097.000
R^2	0.172	0.186	0.160
Panel C: Chinese score			
female students (β_1)	5.265***	4.995***	5.537***
	(0.418)	(0.521)	(0.578)
female teachers (β_2)	0.860	0.580	0.889
	(0.913)	(1.256)	(1.331)
female students × female teachers (β_3)	0.066	0.443	-0.345
	(0.505)	(0.614)	(0.669)
β_2+β_3	0.926	1.022	0.544

	(0.880)	(1.240)	(1.246)
Observations	12940.000	6784.000	6156.000
R^2	0.142	0.151	0.138
Panel D: English score			
female students (β_1)	3.623***	3.301***	4.026***
	(0.601)	(0.771)	(0.865)
female teachers (β_2)	0.919	0.549	1.105
	(0.942)	(1.150)	(1.579)
female students × female teachers (β_3)	0.336	0.566	-0.001
	(0.604)	(0.787)	(0.907)
β_2+β_3	1.254	1.116	1.104
	(0.953)	(1.619)	(1.676)
Observations	13642.000	7042.000	6600.000
R^2	0.226	0.251	0.204

Notes: All regressions control for student characteristics including student's gender, age, ethnic minority status, agricultural hukou status, whether living on campus, whether being a migrant student and difficulty degree of learning in grade 6, household characteristics including parents' education levels, number of siblings and household income level. Robust standard errors clustered at the school level are in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

Since we only find different effect of class teachers' gender, we only take students' average score and class teachers' gender into consideration in the following. As shown in Panel A of Table 3, in large cities, having a female class teacher substantially improve male student's test score, with approximately 2.2 points higher than having s male class teacher. However, the difference of effect mainly concentrate in grade 9 students. The effect is insignificant for male students in large cities, except for grade 9 male students, with around 2.4 points higher when having a female class teacher.

When I divide the analysis sample into students in "the central area of the city", "the urban fringe and rural-urban fringe zone" and "towns and rural areas", the results in Panel B of Table 3 show that female - teacher effect on male students in the central area of the city is relatively small (about 1 points), while on male students in the urban fringe and rural-urban fringe zone is very large (about 2.8 points). The female - teacher effect on female students also concentrate in the urban fringe and rural-urban fringe zone - having a female class teacher increases female students average test score by around 3.2 points.

It is worth noting that, in the the central area of the city, the significant negative β_3 implies that the female - teacher effect on male students is larger than on female students.

TABLE 3—HETEROGENEITY BY CITY SCALE AND LOCATION TYPE

	All students	Grade 7 students	Grade 9 students
Panel A: City scale			
(a) Large cities			
female students (β_1)	4.160***	4.461***	3.330***
	(0.563)	(0.487)	(1.205)
female teachers (β_2)	2.200*	0.674	2.103***
	(1.141)	(1.291)	(0.701)
female students × female teachers (β_3)	-0.300	-0.481	0.315
	(0.536)	(0.586)	(1.201)
β_2+β_3	1.900	0.193	2.418*
	(1.450)	(1.115)	(1.434)
Observations	4108.000	2349.000	1759.000
R^2	0.223	0.247	0.224
(b) Others			
female students (β_1)	4.531***	4.448***	4.633***

	(0.253)	(0.342)	(0.321)
female teachers (β_2)	1.671***	1.737***	1.623**
	(0.524)	(0.591)	(0.705)
female students × female teachers (β_3)	-0.510	-0.482	-0.642
	(0.331)	(0.449)	(0.464)
β_2+β_3	1.161**	1.255**	0.981
	(0.486)	(0.564)	(0.666)
Observations	13480.000	7028.000	6452.000
R2	0.212	0.237	0.190
Panel B: Location type			
(a) The central area of the city			
female students (β_1)	4.359***	4.749***	3.753***
	(0.374)	(0.443)	(0.484)
female teachers (β_2)	1.059**	0.954	1.029*
	(0.494)	(0.848)	(0.547)
female students × female teachers (β_3)	-0.959**	-1.075*	-0.751
	(0.435)	(0.569)	(0.587)
β_2+β_3	0.100	-0.122	0.277
	(0.560)	(0.795)	(0.769)
Observations	6942.000	3723.000	3219.000
R2	0.227	0.261	0.202
(b) Urban fringe and rural-urban fringe zone			
female students (β_1)	4.088***	4.416***	3.891***
	(0.455)	(0.579)	(0.604)
female teachers (β_2)	2.845**	2.484	2.917**
	(1.282)	(1.587)	(1.263)
female students × female teachers (β_3)	0.349	0.572	-0.224
	(0.592)	(0.810)	(0.765)
β_2+β_3	3.194***	3.056**	2.693***
	(1.166)	(1.512)	(0.970)
Observations	4326.000	2390.000	1936.000
R2	0.212	0.250	0.186
(c) Towns and rural areas			
female students (β_1)	4.854***	4.222***	5.408***
	(0.319)	(0.450)	(0.398)
female teachers (β_2)	1.427	1.747*	1.095
	(1.033)	(0.888)	(1.654)
female students × female teachers (β_3)	-0.325	-0.490	0.164
	(0.416)	(0.525)	(0.554)
β_2+β_3	1.102	1.257*	1.259
	(0.994)	(0.743)	(1.624)
Observations	6320.000	3264.000	3056.000
R2	0.214	0.220	0.212

Notes: All regressions control for the same characteristics as in Table 2. Robust standard errors clustered at the school level are in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

B. Robustness Checks

We first conduct robustness tests using subsample regressions by student gender, that is, based on regression model (1). Regressions are separately performed for female and male samples:

$$Score_{icgs} = \beta_0 + \beta_2 FT_{icgs} + \beta_4 X_{icgs} + e_{icgs} \#(3)$$

Where $Score_{icgs}$ denotes the average mid-term test score of three subjects (Math, Chinese and English) for student i in class c of grade g of school s. FT_{icgs} is dummy standing for "female class teachers", which are assigned "1" for female and "0" for male.

The regression results are shown in the Panel A of Table 4. As shown in the table, compared to having a male class teacher, having a female class teacher increases male students' average test score by approximately 1.8 points and increases female students' average test score by around 1.1 points. This is consistent with the results in Table 2.

In view of the fact that the data in this study consists of three parts: the national core sample, the Shanghai sample and the national supplementary sample, among which the Shanghai sample accounts for 8.1% of the total sample, I do the regression after deleting the data from Shanghai to test the robustness of the results. As shown in Panel A of Table 4, the results remain robust to excluding schools in Shanghai. Similarly, as shown in Panel B of Table 4, the estimation results remain almost unchanged when I include only public schools in the sample.[5]

Overall, the robustness check results in Table 4 and the heterogeneity results in Table 3 show that the main results remain robust to various samples.

TABLE 4—ROBUSTNESS CHECKS

	All students	Grade 7 students	Grade 9 students
Panel A: Students' Gender			
(a) Female students			
female teachers (β_2)	1.112**	1.087**	0.920
	(0.480)	(0.527)	(0.645)
Observations	8639.000	4496.000	4143.000
R^2	0.172	0.201	0.153
(b) Male students			
female teachers (β_2)	1.829***	1.757**	1.849***
	(0.548)	(0.695)	(0.687)
Observations	8949.000	4881.000	4068.000
R^2	0.162	0.176	0.149
Panel B: Excluding Shanghai			
female students (β_1)	4.494***	4.478***	4.532***
	(0.236)	(0.298)	(0.314)
female teachers (β_2)	1.725***	1.700**	1.645**
	(0.532)	(0.661)	(0.631)
female students × female teachers (β_3)	-0.383	-0.445	-0.360
	(0.293)	(0.386)	(0.421)
β_2+β_3	1.342**	1.255**	1.285**
	(0.508)	(0.609)	(0.608)
Observations	16281.000	8615.000	7666.000
R2	0.211	0.234	0.192
Panel C: Including only public schools			
female students (β_1)	4.468***	4.432***	4.486***
	(0.224)	(0.278)	(0.302)
female teachers (β_2)	1.795***	1.666***	1.787***
	(0.508)	(0.604)	(0.655)
female students × female teachers (β_3)	-0.494*	-0.534	-0.452
	(0.267)	(0.360)	(0.401)
β_2+β_3	1.301**	1.132**	1.335**
	(0.496)	(0.553)	(0.650)

[5] The 112 schools in the CEPS are classified into two large categories: public schools (112 in total) and private schools (8 in total).

Observations	16341.000	8720.000	7621.000
R2	0.217	0.238	0.197

Notes: All regressions control for the same characteristics as in Table 2. Robust standard errors clustered at the school level are in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

V. Mechanisms

Based on the regression outcomes, a notable pattern emerges where the gender of class teachers holds significant influence, whereas no substantial impact is observed concerning the gender of subject-specific teachers (math, Chinese, and English).

The distinctive effect concerning class teachers' gender prompts an exploration into potential mechanisms driving this discrepancy. It's plausible that the class teacher, as a central figure in a student's academic journey, exerts a more overarching influence on the classroom environment, pedagogical approaches, and student-teacher dynamics. This might involve teaching methodologies, communication styles, or the cultivation of a conducive learning atmosphere, factors that are predominantly shaped by the class teacher's demeanor and instructional techniques.

In contrast, the absence of discernible effects linked to subject-specific teachers' gender could be attributed to a range of factors. These might encompass the nature of subject-specific instruction, where the content and delivery of material might not be as directly impacted by the teacher's gender compared to the broader pedagogical influence exerted by the class teacher. Additionally, the uniformity in subject-specific curricula or standardized teaching practices across different gendered teachers might mitigate observable variations in academic outcomes.

This discrepancy suggests that while class teachers' gender plays a significant role in shaping students' academic achievements, subject-specific teachers' gender might hold a lesser influence due to the subject-focused nature of their instruction or the standardization within subject curricula.

Moreover, the significance of the impact across different geographic locations, as seen in the analysis, introduces the aspect of contextual influence. The differential effects witnessed in large cities, the urban fringe, and rural-urban fringe areas could suggest the role of contextual factors. For instance, the variance in the effect of female teachers on students in urban fringe areas might stem from socio-economic factors, differing school resources, or even cultural aspects that shape the learning environment and student-teacher interactions.

Besides, we notice that in the the central area of the city, the significant negative β_3 implies that the female - teacher effect on male students is larger than on female students. This finding could be attributed to several factors. Firstly, female teachers might have teaching styles and methods that resonate more with male students, making it easier for them to understand and accept instruction from female educators. This could involve communication styles, focal points in teaching, and a match in learning approaches. Another explanation could be that female teachers serve as role models or emotional supports that might be lacking for male students in their homes or other environments. Boys might have fewer opportunities for interaction and guidance from women, and female teachers could fill that gap by providing additional emotional support and guidance. Moreover, the complementary relationship between female teachers and male students could also be a contributing factor. This relationship might enable female teachers to better understand the needs of male students and adjust teaching methods more effectively to meet those needs.

Further exploration is warranted to delve deeper into the intricate dynamics between class teacher gender and its impact on academic achievements, shedding light on the nuanced differences in the instructional roles and influences of class teachers compared to subject-specific instructors.

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			Quality of thesis question(s)
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			Quality/quantity of data used
			Quality of references and sources used
			Written in a clear and concise style?
			Format and structure; Citations/Footnotes
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			Positive response to suggestions given earlier
			Overall