Economics Letters 137 (2015) 54–58

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Do girl peers improve your academic performance?

Feng Hu *

School of Economics and Management, University of Science and Technology Beijing, China

HIGHLIGHTS

- This paper examines gender peer effects on students' academic performance.
- It exploits the random assignment of students to classes within a school.
- A higher share of female peers in the classroom improves students' academic performance, especially for boys.

ARTICLE INFO

Article history:
Received 28 August 2015
Received in revised form
15 October 2015
Accepted 17 October 2015
Available online 23 October 2015

JEL classification:
I21
J16

Keywords:
Peer effects
Academic performance
Female peers
China

ABSTRACT

I study gender peer effects on students' academic performance in China by exploiting the random within-grade-by-school variation in the share of females in the classroom. I find a higher share of girl peers improves students' academic performance, especially for boys.

1. Introduction

The single-sex versus coeducational schooling debate has received much attention from both researchers and policy makers (Halpern et al., 2011). A related question is how the peer gender composition in the classroom affects a student's academic performance. An understanding of this question speaks to the above debate to the extent that the change in gender composition in the classroom affects interactions between male and female students or their learning environment. To date, however, there is limited evidence on this issue (Black et al., 2013; Hill, 2015; Hoxby, 2000; Lavy and Schlosser, 2011), and to the best of my knowledge, there is only one such study (Lu and Anderson, 2015) from the developing world, which examines the effect of female peers surrounding a student in the classroom.

This paper complements the literature by examining gender peer effects on academic performance of middle school students in China. By exploiting the random within-grade-by-school variation in the proportion of females, I find that girl peers have positive effects on students' academic performance, especially on those of boys. I provide suggestive evidences that the benefits may be related to better learning environment resulting from the higher proportion of girl peers.

2. Data and empirical strategy

2.1. Data

The data come from the baseline wave of the China Education Panel Survey (CEPS) conducted by National Survey Research Center (NSRC) at Renmin University of China. It randomly selected approximately 20 000 seventh- and ninth-grade students from 438 classes of 112 schools in mainland China during the 2013–2014 academic year. For each selected school, two classes were randomly chosen for both the seventh and ninth grades, and then all students in the selected classes are surveyed.[1] It is China's

* Correspondence to: University of Science and Technology Beijing, School of Economics and Management, 30 Xueyuan Road, Beijing 100083, China. Tel.: +86 10 62333842; fax: +86 10 62333582.
E-mail address: feng3hu@gmail.com.

http://dx.doi.org/10.1016/j.econlet.2015.10.025
0165-1765/

[1] See NSRC (2015) for the detailed documentation of the CEPS sampling method.

first nationally representative survey targeting middle school students, which is comparable to similar surveys in developed countries such as National Longitudinal Study of Adolescent Health (AddHealth) in US.

The CEPS collected administrative records on students' mid-term examination scores from each school in the fall semester in three compulsory subjects (math, Chinese, and English), the outcomes of interest in this paper. The scores are standardized in terms of school and grade, with a mean of 70 and a standard deviation of 10. It should be noted that the examinations may not be identical across schools because they are usually designed by each school or by local educational authorities. However, this issue may not pose a serious threat to the results of this paper. On one hand, the Ministry of Education imposes national requirements on the content of teaching and examinations in the middle school, and thus examination scores may be comparable across schools to some degree due to the strict requirements. On the other hand, because all students of the same grade within a given school take the same examinations, my fixed effects specification in the following empirical analyses means that I am comparing performance on the same tests of students who have fewer or more girls in their class even if examinations are different across schools.[2]

One unique feature of the CEPS is that it provides the information on whether students were randomly assigned to classes, which allows me to causally estimate gender peer effects.[3] I limit the sample to schools where students are randomly assigned to classes. My final analysis sample includes 9565 students in 219 classes of 74 schools.

Table A.1 of Appendix presents the summary statistics of main variables. The results show that girls are more likely to come from advantaged families with educated parents and high family incomes. In addition, girls perform much better than boys in all the three compulsory subjects, especially in language courses (Chinese and English).

2.2. Empirical strategy

I estimate the following model across subjects and separately for boys and girls:

$$Y_{icgs} = \beta_0 + \beta_1 Peer_{icgs} + \beta_2 X_{icgs} + e_{icgs} \quad (1)$$

where Y_{icgs} denotes the mid-term test scores in the three compulsory subjects (math, Chinese, and English) for student i in class c of grade g of school s. $Peer_{icgs}$ measures the proportion of female students (excluding self) in the classroom in decimals. The covariate vector X_{icgs} contains background characteristics that are important determinants of students' academic performance, including students' age, ethnic minority status, and agricultural hukou status,[4] parents' education levels, number of siblings, and household income level. 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.

However, students may selectively enter schools, especially in China, where parents traditionally invest heavily in children's education. For example, parents may decide whether or not to enroll into one particular school in response to the composition of female peers (Black et al., 2013). To overcome the endogeneity problem, I include grade-by-school fixed effects to account for the most obvious potential confounding factor—the endogenous sorting of students across schools (Hoxby, 2000; Lavy and Schlosser, 2011). The key identification assumption is that girls are randomly assigned to each class within the same grade of a school. This assumption is reasonable given the analysis sample used in this paper.

Another concern is that by the law of large numbers the random process may yield similar proportions of girls across classes within each grade in a school (the mean class-level proportion of girls is 48.16% in the analysis sample).[5] To alleviate this concern, I regress the proportion of girls on grade-by-school dummies by using the class-level dataset. The residuals from this regression can be viewed as the within-grade-by-school variation in the proportion of girls in the class. The descriptive statistics show that the within-grade-by-school variation has a relatively large standard deviation of 0.042, with the minimum and maximum values being −0.174 and 0.174 respectively, suggesting that the above concern is rather minor.

My empirical strategy is similar to Duflo et al. (2011), who use actual randomization to study peer effects. Although my identification comes from school administrators' self-reported information on students' random assignment, next I will do balancing tests to examine whether this random assignment assumption holds.

3. Results

3.1. Balancing tests

As the first column of Table 1 shows, the class-level female peer composition is strongly correlated with many background variables. For example, in classes with higher proportions of girls, students are less likely to hold an agricultural hukou and their parents are more educated. However, after conditioning on school fixed effects in the second column and on grade-by-school fixed effects in the third column, almost all correlations become smaller and statistically insignificant.

Therefore, by conditioning on grade-by-school fixed effects, I can eliminate almost all observed correlations between the female peer composition and students' background characteristics, lending support to the validity of the above identification assumption.

3.2. Estimation results

Now I estimate the effect of class-level female peer composition on students' academic performance separately for boys and girls. As Table 2 shows, I have no controls in the first column, but control for school fixed effects in the second column and grade-by-school fixed effects in the other three columns. In the fourth and fifth columns, I additionally control for individual and household characteristics.

The results show that female peers have positive effects on students' academic performance, especially for boys. For example, a 10% point increase in the proportion of female students increases boys' average English score by two points, which is equivalent to

[2] I also repeat the empirical analysis with students' self-reported academic record rank in the class as the outcome variable. This academic performance measure may be comparable across schools and is very similar to the self-reported GPA score in the National Longitudinal Study of Adolescent Health, which is used in the similar empirical analysis (Hill, 2015). As Table A.3 in Appendix shows, the results with this outcome are consistent with the main results of Table 2.

[3] Both school administrators and homeroom teachers were inquired about students' random assignment to classes. Please consult NSRC (2015) for detailed information.

[4] A hukou is a record in the household registration system in China. It plays an important role like an internal citizenship certificate that is tied to important public benefits exclusively enjoyed by people with local hukou (Chan and Buckingham, 2008).

[5] I thank the reviewer for pointing to this issue.

Table 1
Balancing tests: Coefficients on the share of female peers in the class.

	No controls	School fixed effects	Grade-by-school fixed effects
Panel A: Student characteristics			
Age	0.148	0.895	0.235
	(0.963)	(1.450)	(0.183)
Minority	−0.121	−0.031	0.010
	(0.435)	(0.043)	(0.050)
Agricultural hukou	−0.644**	0.003	0.065
	(0.262)	(0.159)	(0.217)
Panel B: Household characteristics			
Father's years of education	3.827*	0.356	0.885
	(2.028)	(0.647)	(1.137)
Father having at least high school education	0.548*	0.092	0.181
	(0.288)	(0.105)	(0.182)
Mother's years of education	4.600	0.849	1.288
	(2.994)	(0.702)	(1.119)
Mother having at least high school education	0.624**	0.150	0.238
	(0.280)	(0.093)	(0.146)
Number of siblings	−0.675	−0.269	−0.500**
	(0.513)	(0.166)	(0.249)
Dummy for low household income	−0.026	0.074	0.010
	(0.216)	(0.107)	(0.172)

Robust standard errors clustered at the school level are shown in parentheses.
* Significant at 10% level.
** Significant at 5% level.

Table 2
Effects of female peer composition on academic performance.

	(1)	(2)	(3)	(4)	(5)
Panel A: Females					
(a) Math	1.17	3.41	5.97	5.76	4.76
	(2.36)	(3.44)	(5.92)	(5.73)	(5.56)
Observations	4537	4537	4537	4537	4537
(b) Chinese	−5.24**	−1.29	3.10	2.97	2.30
	(2.10)	(3.09)	(4.67)	(4.59)	(4.39)
Observations	4537	4537	4537	4537	4537
(c) English	−1.89	0.92	6.93	6.67	5.76
	(2.35)	(2.78)	(4.85)	(4.67)	(4.50)
Observations	4538	4538	4538	4538	4538
Panel B: Males					
(a) Math	4.49*	10.25***	17.31***	17.38***	16.53***
	(2.28)	(3.60)	(5.40)	(5.29)	(5.21)
Observations	4774	4774	4774	4774	4774
(b) Chinese	1.65	7.43**	14.27**	14.34***	13.60**
	(2.22)	(3.65)	(5.48)	(5.38)	(5.25)
Observations	4775	4775	4775	4775	4775
(c) English	2.08	8.58**	20.41***	20.63***	19.76***
	(2.08)	(3.79)	(6.54)	(6.27)	(6.09)
Observations	4773	4773	4773	4773	4773
School fixed effects	No	Yes	–	–	–
Grade-by-school fixed effects	No	No	Yes	Yes	Yes
Individual characteristics controls	No	No	No	Yes	Yes
Household characteristics controls	No	No	No	No	Yes

Individual characteristics controls include age, ethnic minority status, and agricultural hukou status. Household characteristics controls include parents' education levels, number of siblings, and dummy for low household income level. Robust standard errors clustered at the school level are shown in parentheses.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

0.2 standard deviations given its standard deviation of 10 points. The results are consistent with previous studies such as Hoxby (2000) and Lavy and Schlosser (2011) that show both boys and girls benefit from a higher share of female peers in the classroom. The estimates remain almost unchanged after adding individual and household characteristics in the fourth and fifth columns, suggesting that students are randomly assigned to classes within the same grade of a school.

Why do female peers have positive effects on academic performance of students in the classroom? One possible mechanism may be related to better learning environment resulting from high proportions of female peers (Lavy and Schlosser, 2011). In Table A.2 of Appendix, I provide suggestive evidences on possible positive spillover effects from female peers by comparing the school lives of girls and boys. The results show that conditioning on grade-by-school fixed effects, girls are less likely to be problematic than boys: they are less likely to be late for school and to skip classes, and receive fewer criticisms and more praises from teachers. Furthermore, females are more likely to create better learning environment through interactions with others: they are easier to get along with, feel closer to fellow students, and are more likely to report a good learning environment in the class.

Table A.1
Summary statistics of main variables: Female vs. male students.

	Female students	Male students	Difference
Panel A: Student characteristics			
Age	13.40	13.50	−0.10***
Minority (%)	11.43	10.97	0.46
Agricultural hukou (%)	46.04	48.15	−2.11**
Panel B: Household characteristics			
Father's years of education	10.78	10.61	0.17**
Father's education level (%)			
Primary school or below	13.66	14.34	−0.68
Middle school	40.30	41.89	−1.58
High/technical school	24.88	24.40	0.47
College or above	21.17	19.37	1.79**
Mother's years of education	10.09	9.91	0.18**
Mother's education level (%)			
Primary school or below	20.41	23.00	−2.59***
Middle school	39.29	37.71	1.58
High/technical school	22.78	22.64	0.15
College or above	17.52	16.65	0.87
Number of siblings	0.71	0.61	0.10***
Household income level (%)			
Low	15.25	18.28	−3.02***
Middle	78.04	74.56	3.47***
High	6.71	7.16	−0.45
Panel C: Mid-term standardized scores			
Math	70.93	69.49	1.44***
Chinese	73.11	67.39	5.72***
English	72.92	67.56	5.36***
Observations	4635	4930	

Column 3 shows the difference in characteristics between female and male students with t-test results.
** Significant at 5% level.
*** Significant at 1% level.

Table A.2
School lives: Female vs. Male students.

	Coefficient on the female student dummy	Observations
I am often late for school	−0.050***	9507
	(0.018)	
I often skip classes	−0.043***	9503
	(0.011)	
My parents frequently receive teachers' criticism about me	−0.230***	9479
	(0.018)	
The homeroom teacher often praises me	0.062***	9453
	(0.018)	
The homeroom teacher often criticizes me	−0.257***	9464
	(0.019)	
Most classmates are friendly to me	0.110***	9465
	(0.017)	
I think I am easy to get along with	0.070***	9472
	(0.017)	
The learning environment is good in the class	0.127***	9459
	(0.018)	
I often participate in activities organized by the school or class	0.105***	9466
	(0.021)	
I feel close to students in the school	0.096***	9405
	(0.020)	
I feel bored in the school	−0.067***	9424
	(0.019)	
I hope I can be transferred to another school	−0.007	9482
	(0.020)	

All regressions control for grade-by-school fixed effects. Robust standard errors clustered at the school level are shown in parentheses.
*** Significant at 1% level.

4. Conclusions

This paper exploits the random within-grade-by-school variation in the share of females in the classroom to show that a higher share of girl peers improves students' academic performance and the benefits are larger for boys. I provide suggestive evidences that the benefits may be related to better learning environment resulting from higher proportions of female peers. This suggests that

Table A.3
Effects of female peer composition on the self-reported academic rank in the class.

	(1)	(2)	(3)	(4)	(5)
Panel A: Females					
Female peer composition	0.15	0.11	0.26	0.25	0.11
	(0.35)	(0.24)	(0.31)	(0.30)	(0.30)
Observations	4619	4619	4619	4619	4619
Panel B: Males					
Female peer composition	0.92***	0.97***	1.19***	1.21***	1.11***
	(0.29)	(0.32)	(0.39)	(0.40)	(0.40)
Observations	4894	4894	4894	4894	4894
School fixed effects	No	Yes	–	–	–
Grade-by-school fixed effects	No	No	Yes	Yes	Yes
Individual characteristics controls	No	No	No	Yes	Yes
Household characteristics controls	No	No	No	No	Yes

Individual characteristics controls include age, ethnic minority status, and agricultural hukou status. Household characteristics controls include parents' education levels, number of siblings, and dummy for low household income level. Robust standard errors clustered at the school level are shown in parentheses.
*** Significant at 1% level.

increasing interactions between girls and boys in the classroom may be an effective and low-cost way to improve academic performance, especially for boys.

Acknowledgments

I wish to thank the editor Costas Meghir, the reviewer, and Alex Eble from Brown University for very helpful suggestions. I also thank the Chinese National Survey Data Archive (http://www.cnsda.org/index.php) for access to the CEPS data. I acknowledge the financial support from National Natural Science Foundation of China (grant nos. 71373002, 71133003, 71420107023), Beijing Social Science Foundation, and Fundamental Research Funds for the Central Universities (Jingpin Wenke, grant no. FRF-BR-15-001B).

Appendix

See Tables A.1–A.3.

References

Black, Sandra E., Devereux, Paul J., Salvanes, Kjell G., 2013. Under pressure? The effect of peers on outcomes of young adults. J. Labor Econ. 31 (1), 119–153.
Chan, Kam Wing, Buckingham, Will, 2008. Is China abolishing the hukou system? China Quart. 195, 582–606.
Duflo, Esther, Dupas, Pascaline, Kremer, Michael, 2011. Peer effects, teacher incentives, and the impact of tracking: Evidence from a randomized evaluation in Kenya. Amer. Econ. Rev. 101 (5), 1739–1774.
Halpern, Diane F., Eliot, Lise, Bigler, Rebecca S., Fabes, Richard A., Hanish, Laura D., Hyde, Janet, Liben, Lynn S., Martin, Carol Lynn, 2011. The pseudoscience of single-sex schooling. Science 333 (6050), 1706–1707.
Hill, Andrew J., 2015. The girl next door: The effect of opposite gender friends on high school achievement. Am. Econ. J.: Appl. Econ. 7 (3), 147–177.
Hoxby, Caroline, 2000. Peer effects in the classroom: Learning from gender and race variation. Natl. Bur. Econ. Res. http://www.nber.org/papers/w7867.
Lavy, Victor, Schlosser, Analía, 2011. Mechanisms and impacts of gender peer effects at school. Am. Econ. J.: Appl. Econ. 3 (2), 1–33.
Lu, Fangwen, Anderson, Michael L., 2015. Peer effects in microenvironments: The benefits of homogeneous classroom groups. J. Labor Econ. 33 (1), 91–122.
National Survey Research Center (NSRC). User Manual for the CEPS Baseline Survey (in Chinese) 2015. Available at: http://ceps.ruc.edu.cn/assets/admin/org/ueditor/php/upload/20150415/14290791249394.pdf (Accessed on 19.08.15).