Migrant peers in the classroom: Is the academic performance of local students negatively affected?

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ABSTRACT

This paper provides the first causal estimates of the impact of internal migrant peers on the academic performance of local students in developing countries. By exploiting the random assignment of students to classes within a school, I find that migrant peers have large and negative effects on the academic performance of local students in China and the negative spillover effects are concentrated among male students and among local students in large cities. The investigation of the underlying mechanisms suggests that the negative migrant spillover effects may come from the worsened learning environment or from the adjustment of teachers' pedagogical practices in response to the migrant composition in the classroom.

1. Introduction

The association between immigrant peers and educational attainment of native students in developed countries has been extensively analyzed in the literature (Card, 2013; Geay et al., 2013; Gould et al., 2009; Hunt, 2016; Jensen and Rasmussen, 2011; Ohinata et al., 2013; Schneeweis, 2015).[1] However, given the fact that the scale of internal migration flows is several times that of international migration flows,[2] it is surprising that little is known about the effect of internal migrant peers on the academic performance of local students in developing countries.[3] Furthermore, very few studies to date have explored underlying mechanisms of migrant peer effects. To the best of my knowledge, only Ohinata et al. (2013) have directly examined this issue in the Netherlands. This paper aims to fill the literature gap by studying the causal effect of internal migrant peers on the academic performance of local middle-school students in China and by exploring underlying mechanisms.

As the developing country with the largest internal migration flows, China is an interesting setting to explore the above issue. On one hand, since China's reform and opening up in the late 1970s, the scale of China's internal migration flows has increased dramatically from less than 7 million in 1982 to 221 million in 2010 according to China's population census data (Duan et al., 2013). Accordingly, the size of China's migrant children has expanded rapidly, reaching 36 million in 2010. Like the public concern over the educational impact of large immigrant inflows into western countries, the rapid increase in the share of migrant students in the classroom has aroused China's parents' concerns that the academic performance of their children may be negatively affected

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[1] Ohinata and van Ours (2013) provide an excellent literature review of the spillover effects of immigrant children on the education of native students.

[2] In the past decades, the developing world has witnessed continuously expanding large internal migration flows, especially rural-to-urban migration flows. According to United Nations Population Division (2013), it is estimated that there were 214 million international migrants and 763 million internal migrants around the world in 2009.

[3] The possible reason may be the lack of relevant high-quality survey datasets in developing countries.

(Betts and Fairlie, 2003).[4] On the other hand, China has implemented a unique hukou (household registration) system that has acted like an internal passport system and restricted population mobility since the 1950s. Until now, the hukou is still tied to many important public benefits that are exclusively enjoyed by people with local hukou, such as government-provided affordable housing, health care, social security, and most importantly, children's education (Afridi et al., 2015; Chan and Buckingham, 2008).

This paper examines the spillover effect of internal migrant peers on the academic performance of local students in China by using a nationally representative middle school student survey – China Education Panel Survey (CEPS). This survey contains the unique information on whether students are randomly assigned to classes within each grade of a school, which enables me to circumvent the endogeneity problem that has plagued previous peer effect studies (Card, 2013; Ohinata et al., 2013).[5] Specifically, I exploit idiosyncratic variations in the proportion of migrant peers across classes within the same grade of a school to account for differences in unobserved or other observed factors across grades within schools.

To preview the main findings, the presence of migrant peers in the classroom has large and negative effects on the academic performance of local students, especially for male students and for local students in large cities. For instance, a ten-percentage-point increase in the proportion of migrant students in the classroom reduces math test scores of local students by 0.11 standard deviations, those of male students by 0.16 standard deviations, and those of local students in large cities by 0.2 standard deviations. The results are robust to various analysis samples and to alternative definitions of migrant students. The investigation of the underlying mechanisms suggests that the negative migrant spillover effect may come from the worsened learning environment or from the adjustment of teachers' pedagogical practices in response to the migrant composition in the classroom.

This study contributes to the literature in the following ways. First, previous studies focus on the spillover effects of "immigrant" students on the education of native students in developed countries. To the best of my knowledge, this paper is the first to study the causal effects of "internal" migrant peers on the academic performance of local students in a developing country. Second, almost no previous studies have explored the mechanisms through which migrant peers affect academic performance of native students due to data limitations. In this paper I exploit the rich information contained in the CEPS to explore possible mechanisms. Finally, this paper exploits the random assignment of students to classrooms and is among the very few studies that provide credible causal evidence on the relationship between migrant peers and academic performance of local students.

The rest of this paper is structured as follows. Section 2 introduces the background on education of China's migrant children and on class assignment rules in China's middle schools. Section 3 describes the data source and defines main variables. Section 4 discusses the empirical strategy. Section 5 presents the main empirical results and does robustness checks. Section 6 explores possible mechanisms. The final section concludes.

2. Background

2.1. Education of China's migrant children

Unlike the population registration system in other countries that functions as a statistical or recording system, China's unique hukou system is more like an internal passport system (Afridi et al., 2015; Chan and Buckingham, 2008; Hu et al., 2011). Although this institutional barrier has been gradually relaxed in the past three decades and people are now allowed to travel freely across regions in China, people without local hukou still face many difficulties in their daily lives (Chan and Buckingham, 2008; Goodburn, 2009). The hukou still plays an important role like an internal "citizenship" certificate in China: it is tied to many important public benefits that are exclusively enjoyed by people with local hukou, such as government-provided affordable housing, health care, social security, and most importantly, children's education (Chan and Buckingham, 2008).

On the other hand, after China's reform and opening up in the late 1970s and the gradual relaxation of population mobility since then, the scale of China's internal migration flows has increased dramatically from less than 7 million in 1982 to 221 million in 2010 according to China's population census data (Duan et al., 2013). Accordingly, the size of China's migrant children has increased to 36 million in 2010, compared to almost no migrant children in the early 1980s. Given the large scale of incoming migrant children, it is challenging for local city governments to provide sufficient public educational services for them.

Although all children, including migrant children without local hukou, are required to take the free nine-year compulsory education by the law,[6] local county/district-level governments lack the incentives and financial resources to satisfy the needs of migrant children because the educational budget is allocated to administrative counties or districts in terms of the number of students with local hukou and is not portable across counties or districts (Chen and Feng, 2013; Goodburn, 2009). Therefore, many migrant children are excluded from local public schools and have to enter private or migrant schools that require low tuition fees but have low teaching quality.[7] According to the CEPS survey data used in this paper, 15.5% of migrant students still study in private or migrant schools. In large migration destination cities, the proportion is even much larger. For example, among about one half million migrant students in Shanghai, about 30% of them are enrolled in private or migrant schools in 2010 (Chen and Feng, 2013; Li et al., 2014).

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[4] For example, some migrant students in Zhejiang province had to give up joining regular classes due to the strong objections from local parents, and finally they formed a migrant-student-only class. See the Chinese web link at http://news.sina.com.cn/s/2011-08-19/064723016234.shtml.

[5] Students may be selectively allocated to schools or classes in a school, especially in China, where parents traditionally invest heavily in children's education.

[6] China's compulsory education law requires that children receive nine years of schooling, including the first to sixth grades in the primary school and the seventh to ninth grades in the middle school.

[7] For example, one report shows that among the surveyed 300 migrant schools in Beijing, only 63 were licensed. Teachers in those schools had low wages but intense workload, and their turnover was high. See http://www.clb.org.hk/en/content/migrant-workers-and-their-children for more details.

Even for migrant students who fortunately attend public schools, they may face much higher barriers than local students and have to pay many extra fees including so-called "temporary student fees", "school selection fees", "sponsorship fees", and other miscellaneous fees. Migrant parents who want to send their children to public schools also have to prepare an array of extra documents or certificates that they are usually unable to provide (Chen and Feng, 2013; Goodburn, 2009; Li et al., 2014).

2.2. Class assignment in China's middle schools

According to the new compulsory education law in 2006, class tracking based on students' academic performance or their migrant (hukou) status is banned in the middle school.[8] There are mainly two officially "allowed" ways of assigning students into classes in China's middle schools: (1) purely random assignment and (2) "average" assignment based on students' academic performance in terms of primary school graduation examinations or diagnostic examinations arranged by the middle school. In the former, after primary school graduates are assigned to a neighborhood middle school according to requirements of local educational authorities, they are randomly assigned to classes by a lottery or in other ways (for instance, students are assigned to classes according to their surnames' alphabetical order), not based on their academic performance.

In the latter, students are assigned to classes in terms of their academic performance when they enter the seventh grade, but according to a "balanced assignment" rule, such that the average quality of students are comparable across classes (Carman and Zhang, 2012). Assume that one middle school has a total of 200 incoming seventh-grade students, who will be assigned to five classes. Students are first ranked by their total scores on primary school graduation examinations and then are assigned to classes according to their score ranks. For example, the top five and the bottom five students are assigned to the five classes respectively, with the best (ranked the first) and the worst (ranked the 200th) students in the same class. That is, the average rank of students is kept about the same (=100.5) in each class.[9]

Compared with many western countries, where admissions to high schools or universities are based on multiple dimensions such as teacher recommendations and personal leadership potential, China's admissions are almost exclusively based on entrance examinations (Zhang, 2016). Furthermore, the promotion of China's middle school administrators and teachers (like government officials) is largely based on students' academic performance in examinations, especially in the high school entrance examination (Karachiwalla and Park, 2017). To prepare for the entrance examination, therefore, some middle schools may assign students into classes based on their academic performance despite the banning of class tracking according to the compulsory education law. Accordingly, school administrators channel more resources (for instance, high-quality teachers) to classes with high-ability students so that they have a better performance record at the high school entrance examinations.[10] In some cases, students may be reassigned to different classes based on their academic performance after one semester or one year even if they are randomly or averagely assigned at the beginning of the seventh grade.[11]

3. Data

The data come from the baseline wave of the China Education 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 ambitiously aims to track middle school students through their educational progress and later labor market activities throughout their life cycles.[12] The baseline survey of the CEPS adopted a stratified, multistage sampling design with probability proportional to size, randomly selecting approximately 20,000 seventh- and ninth-grade students from 438 classes of 112 schools in 28 counties in mainland China during the 2013–2014 academic year.[13] For each selected schools, two classes were randomly chosen for both seventh and ninth grades, and then all students in the selected classes were surveyed.[14]

The CEPS collected detailed information on students' hukou status, which allows me to define the key explanatory variables used in this paper. First, I define a migrant student as the one whose place of residence is outside her home county where her hukou belongs to.[15] Then I construct the class-level migrant peer composition based on the proportion of migrant students in the classroom.[16] Except for students' individual characteristics, the CEPS collected their family background information, such as number of

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[8] According to the school administrator survey of the CEPS used in this paper, only one out of 109 schools has assigned newly enrolled seventh-grade students in terms of migrant (hukou) status.

[9] Carman and Zhang (2012) provide a detailed description of how this type of class assignment operates.

[10] Usually, schools in larger cities are more likely to comply with the ban on student tracking because they are more likely to be monitored by educational authorities. For instance, in 2014 the Ministry of Education (MOE) of China issued an additional regulation (http://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/s7966/201402/164088.html) to monitor student tracking at the time of students' middle school admission in large cities.

[11] According to the CEPS survey data used in this paper, about 85% of middle schools assigned newly enrolled students to classes in a random or an average way and one third of those schools reassigned students based on past academic performance when they entered the eighth or ninth grade.

[12] It is comparable to similar surveys in developed countries such as Adolescent Health Longitudinal Studies (AddHealth) in U.S. and National Education Panel Survey (NEPS) in Europe.

[13] It oversampled counties in both large migrant-sending regions and large migrant destination regions like Shanghai to reflect China's historically unprecedented internal migration flows.

[14] In the survey very few schools (less than 5%) have only one sampled class for each grade. See National Survey Research Center at Renmin University of China (2015) for the detailed documentation of the sampling method used in the CEPS.

[15] This migrant definition is consistent with other studies (for instance, Chen and Feng, 2013).

[16] The proportion of migrant children in a class remains about 30% when the class size is below 50 and then declines when the class size is more than 50. See Table A1 of the Appendix for more details.

siblings, parents' education, and household income levels, which may be important determinants of students' academic performance.

The CEPS also contains detailed information on students' academic performance, the outcome of interest in this paper. Except for self-reported academic performance indicators at the sixth grade in the primary school, it collected administrative school records on students' mid-term test scores in the following three compulsory subjects: math, Chinese, and English. The scores are standardized in terms of school and grade, with the mean of 70 and the standard deviation of 10.

One unique feature of the CEPS is that it contains the information on class assignment rules. Both school administrators and homeroom teachers were inquired about whether students were randomly assigned to classrooms or whether they were (re)assigned in terms of academic performance.[17] In this paper I limit the sample to those schools whose administrators randomly or averagely assigned newly enrolled seventh-grade students to classes and did not reassign eighth- or ninth-grade students to classes in terms of their previous academic performance.[18] I further limit the analysis sample to the schools whose homeroom teachers reported no student tracking (allocating students to classes in terms of academic performance in a non-average way). Finally, the sample used in the analysis includes 8964 students, comprising of 1937 migrant students and 7027 local students in 215 classes of 86 schools.[19]

Table 1 presents the summary statistics of main variables for migrant and local students in the seventh and ninth grades of the middle school. Panels A and B show that migrant students are much more likely to hold agricultural hukou, pointing to the ongoing large rural-urban migration flow in China.[20] As expected, migrant students tend to have less educated parents and more siblings, suggesting that migrant students may be disadvantaged in their family resources.

Panel C shows a consistent pattern between mid-term test scores in the middle school[21] and recalled difficulty degrees of learning in the primary school[22]: local students show more advantages in learning English than migrant students, but almost no differences in learning math and Chinese. While the summary statistics are suggestive, I next further examine the causal effect of the presence of migrant peers in the classroom on the academic performance of local students.

4. Empirical strategy

The goal of this paper is to examine the causal effect of class-level migrant peer composition on the academic performance of local students in China. If students are randomly assigned to classes, we can obtain the unbiased peer effect estimates by running the following regression across subjects using the OLS method:

$$Y_{icgs} = \beta_0 + \beta_1 Peer_{icgs} + \beta_2 X_{icgs} + e_{icgs} \tag{1}$$

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. $Peer_{icgs}$ is the key explanatory variable that measures the proportion of migrant students in the class. The covariate vector X_{icgs} represents the predetermined student's individual and family characteristics that are important determinants of individual academic performance, including students' gender, age, ethnic minority status, and agricultural hukou status, 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, it is usually difficult to detect the causal effect of migrant peer composition on the academic performance of local students because the migrant peer composition is likely to be an outcome of school or family choices (Card, 2013; Ohinata et al., 2013). Students may sort into schools or classes in a school, especially in China, where parents traditionally invest heavily in children's education. The proportion of migrant children in a school may even affect the mobility of students across schools (Betts and Fairlie, 2003; Lavy et al., 2012). That is, the possibly worse academic performance of local students may not be due to the spillover effect from migrant peers, but a result of school sorting, suggesting a self-selection problem documented in the peer effect literature (Geay et al., 2013; Manski, 1993). It is also possible that schools are located in communities that are over-crowded and have poor facilities, and thus both migrant and local students suffer from a common unfavorable environment. Therefore, the OLS estimates ($\beta1$) of the peer effect are likely to be biased if we do not take into account those unobservable confounders.

To overcome the endogeneity problem in estimating peer effects, the literature usually employs the following two empirical strategies[23]: the first is related to exploiting the random assignment of peers. For example, Sacerdote (2001) and Zimmerman (2003) exploit the fact that the first-year U.S. university students are randomly assigned into rooms to study the peer effects on roommates' academic performance. Li et al. (2014) use a randomized trial to examine the role of group incentives in encouraging classroom peer

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[17] Specifically, school administrators were inquired about whether newly enrolled seventh-grade students were randomly or averagely assigned to classes and whether senior (eighth- and ninth-grade) students were reassigned to classes afterwards in terms of academic performance. In addition, homeroom teachers were further inquired about whether students were allocated into classes within a grade in terms of their academic performance. Both random and average student assignment rules can be viewed as "random" as I have discussed in the Section 2.

[18] In the following analysis, I use the term "random assignment" to refer to the two officially allowed ways of assigning students to classes in China: "random assignment" and "average assignment."

[19] As shown in Table A2 of the Appendix, the schools with random student assignment rules (used in the analysis of this paper) are more urbanized and have a relatively higher ranking than those schools excluded from the analysis.

[20] The recent national migration survey shows that the scale of China's rural-urban migration flow has arrived at 169 million by the end of 2016 (National Bureau of Statistics of China, 2017).

[21] We should bear in mind that standardized scores are not comparable across schools when interpreting the descriptive statistics.

[22] 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").

[23] For a thorough review of the experimental and quasi-experimental methods used in the analysis of peer effects, please refer to Sacerdote (2014).

Table 1

Summary statistics of main variables: local vs. migrant students.

Source: Baseline wave of CEPS.

	All students	Local students	Migrant students	Difference
Panel A: Student Characteristics				
Male (%)	51.68	51.32	53.02	−1.70
Age	13.23	13.25	13.13	0.12***
Minority (%)	11.59	12.69	7.59	5.10***
Agricultural hukou (%)	49.06	45.82	60.82	−14.99***
Panel B: Household Characteristics				
Father's years of education	10.65	10.76	10.27	0.49***
Father's education level (%)				
Primary school or below	14.03	13.60	15.59	−1.99**
Middle school	41.13	40.12	44.81	−4.69***
High/technical school	25.58	25.67	25.25	0.43
College or above	19.25	20.61	14.35	6.25***
Mother's years of education	9.92	10.06	9.40	0.67***
Mother's education level (%)				
Primary school or below	22.61	21.29	27.41	−6.12***
Middle school	37.90	37.04	40.99	−3.95***
High/technical school	23.03	23.82	20.13	3.69***
College or above	16.47	17.85	11.46	6.38***
Number of siblings	0.70	0.66	0.87	−0.21***
Household income level (%)				
Low	18.31	18.73	16.78	1.95**
Middle	74.91	74.38	76.82	−2.44**
High	6.78	6.89	6.40	0.49
Panel C: Academic Performance				
Mid-term standardized score				
Math	70.25	70.25	70.24	0.02
Chinese	70.24	70.15	70.57	−0.41
English	70.26	70.32	70.00	0.32
Difficulty degree of learning in grade 6				
Math	2.90	2.91	2.87	0.04
Chinese	3.16	3.16	3.17	−0.01
English	2.80	2.82	2.69	0.13***
Observations	8964	7027	1937	

Notes: Column 4 shows the difference in characteristics between local and migrant students with *t*-test results. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

interactions in China. The second strategy is about assuming the peer composition to be randomly determined after controlling for school fixed effects. For example, Ammermueller and Pischke (2009) rely on the variation across classes within schools to study the effect of peer composition on reading test scores of European primary school students. Ohinata et al. (2013) also exploit the within-school variations to examine the spillover effects of immigrant peers on the academic achievement of native Dutch children.[24]

In this paper I employ a strategy (Hu, 2015) similar to the first one mentioned above to address the possible endogeneity concern of migrant student composition in the classroom. That is, I exploit the unique information regarding the class assignment rule contained in the CEPS by limiting the analysis to the schools where newly enrolled seventh-grade students were randomly (or "averagely") assigned to classes and senior (eighth- and ninth-grade) students were not reassigned afterwards in terms of academic performance.[25]

By using the restricted sample, the migrant peer composition ($Peer_{icgs}$) should be orthogonal to the error term (ε_{icgs}) after conditioning on grade-by-school fixed effects (μ_{gs}), and the covariate vector X_{icgs} is expected to have little impact on the estimated coefficients, but to increase the estimation precision.

$$e_{icgs} = \mu_{gs} + \varepsilon_{icgs} \tag{2}$$

Therefore, I compare the academic performance of local students who have similar characteristics, except that one class has a relatively higher or lower proportion of migrant students than the other class within the same grade of a school due to random

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[24] The second identification strategy may still suffer from endogeneity problems because students may not be randomly placed into classes within a grade (Gould et al., 2009). For instance, schools may allocate students to classes based on their characteristics (such as previous academic performance or migrant status) or parents may still strategically choose classes within a school out of the concern about migrant peers in the classroom (Hunt, 2016). The problem becomes less serious when studying the grade-level (rather than class-level) peer composition.

[25] I further limit the analysis sample to the schools whose homeroom teachers reported no allocation of students to classes in terms of academic performance in a non-average way.

Table 2
Balancing tests for the class-level migrant composition.

	No controls	School fixed effects	Grade-by-school fixed effects
Panel A: Student Characteristics			
Male	0.022	0.025	−0.105
	(0.041)	(0.089)	(0.148)
Age	−1.056**	−4.696***	0.240
	(0.456)	(1.119)	(0.160)
Minority	−0.271	−0.024	−0.017
	(0.178)	(0.042)	(0.054)
Agricultural hukou	−0.752***	−0.036	0.091
	(0.167)	(0.142)	(0.167)
Panel B: Household Characteristics			
Father's years of education	3.257***	−1.011	−1.733
	(1.182)	(0.742)	(1.248)
Father having at least high school education	0.502***	−0.093	−0.234
	(0.164)	(0.112)	(0.188)
Mother's years of education	4.147***	−0.455	−0.703
	(1.527)	(0.705)	(1.173)
Mother having at least high school education	0.490***	0.013	0.036
	(0.161)	(0.104)	(0.149)
Number of siblings	−0.875***	−0.030	−0.237
	(0.298)	(0.182)	(0.209)
Dummy for low household income	−0.388***	0.074	0.074
	(0.107)	(0.061)	(0.092)

Notes: The numbers are the estimated coefficients on the proportion of migrant students in the classroom for 30 separate regressions, with local students' ten background variables as outcomes and the three specifications being no controls, controlling for school fixed effects, and controlling for grade-by-school fixed effects. Robust standard errors clustered at the school level are shown in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

factors.[26] Although my identification comes from school administrators' self-reported information on whether students are randomly assigned to classes, in the next Section 1 will do balancing tests to provide at least suggestive evidence that students were indeed randomly assigned to classes in those schools.

5. Estimation results

In this Section 1 first do balancing tests to check the underlying assumption that students are randomly assigned to classes within the same grade of a school. Then I present main estimation results with standardized test scores of the three compulsory subjects. Finally, I do robustness checks by running placebo tests with students' previous academic performance as outcomes and by using various samples and alternative definitions of the key explanatory variable.

5.1. Balancing tests

Before presenting the main empirical results, I examine the validity of the underlying assumption used in this paper: the variation in the class-level migrant composition should be random conditional on grade-by-school fixed effects. That is, the migrant composition is expected to be uncorrelated with any predetermined local students' background characteristics. Next I run separate regressions with each background characteristic as outcomes to test this assumption.[27]

As the first column of Table 2 shows, the migrant composition in the class is strongly correlated with almost all background characteristics of local students without controls. For example, in those classes with higher migration student proportions, local students have fewer siblings, their parents are more educated, and their families are richer. These results may reflect that migrant students are more likely to attend schools located in rich or urban communities rather than in rural or poor ones. As expected, after conditioning on school fixed effects in the second column and grade-by-school fixed effects in the third column, all correlations become much smaller and statistically insignificant, suggesting that the class-level migrant composition is balanced along local students' background characteristics.

Therefore, by conditioning on grade-by-school fixed effects, I am able to eliminate all observed correlations between the migrant composition and local students' background characteristics, lending support to the validity of the underlying assumption in this

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[26] People may be worried about whether there is sufficient variation in the share of migrant peers for estimating the effect of this share on local students' academic performance because migrant peers are randomly assigned to classes in the analysis sample. However, the concern may be minor given that the within-grade-by-school standard deviation of the share of migrant peers is relatively large (6.56%). Fig. A1 shows the distribution of the share of migrant peers within grades of a school.

[27] I also implement similar balancing tests with the full sample. As Table A3 in the Appendix shows, even after conditioning on grade-by-school fixed effects, the proportion of migrant peers in the class is significantly correlated with student's age and parents' education, suggesting that students may not be randomly assigned to classes within a school in the full sample.

Table 3
Effects of migrant composition on local students' standardized test scores: main results.

	(1)	(2)	(3)	(4)	(5)
Panel A: Math					
Proportion of migrant peers in the class	−2.010**	−7.282***	−11.636***	−11.251***	−10.639***
	(0.781)	(2.373)	(4.020)	(3.949)	(4.020)
R^2	0.001	0.015	0.021	0.037	0.058
Observations	6858	6858	6858	6858	6858
Panel B: Chinese					
Proportion of migrant peers in the class	−1.890**	−5.980***	−10.880***	−11.074***	−10.588***
	(0.742)	(2.058)	(3.347)	(2.998)	(3.004)
R^2	0.001	0.015	0.025	0.120	0.134
Observations	6858	6858	6858	6858	6858
Panel C: English					
Proportion of migrant peers in the class	−1.173	−3.152	−3.811	−3.731	−3.028
	(0.960)	(2.121)	(4.031)	(3.573)	(3.473)
R^2	0.000	0.019	0.025	0.116	0.136
Observations	6859	6859	6859	6859	6859
School fixed effects	No	Yes	No	No	No
Grade-by-school fixed effects	No	No	Yes	Yes	Yes
Individual characteristics	No	No	No	Yes	Yes
Household characteristics	No	No	No	No	Yes

Notes: Individual characteristics include a student's gender, age, ethnic minority status, and agricultural hukou status. Household characteristics 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 percent level, ** significant at 5 percent level, * significant at 10 percent level.

paper. That is, the estimates in the following analysis are unlikely to be biased due to unobserved confounders and I can feel safe to interpret the estimates as causal evidence.[28]

5.2. Effects on local students' academic performance: main results

Given the random assignment of students into classes within the same grade of a school, next I examine the causal effect of class-level migrant peer composition on local students' mid-term academic performance in the following three compulsory subjects: math, Chinese, and English.

Panel A of Table 3 reports the estimates of the migrant peer effect on local students' standardized math test scores. 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 final two columns, I also control for students' individual and household characteristics respectively. The results show that the presence of migrant peers in the classroom has negative and statistically significant effects on math scores of local students. According to the preferred specification in the last column, a ten-percentage-point increase in the proportion of migrant students in the classroom reduces local students' math test scores by 1.06 points, which is equivalent to 0.11 standard deviations given the standard deviation of 10 points in the CEPS.[29] My findings are consistent with but relatively larger than the estimates by Diette and Oyelere (2014) and Jensen and Rasmussen (2011), who examine the impact of immigrant students in the U.S. or in European countries. The estimates remain almost unchanged after adding individual and household characteristics in the final two columns, which is consistent with my argument that students are randomly assigned to classes within a school in the analysis sample.

The results of Panel B show that migrant peers have large and negative effects on local students' Chinese test scores. a ten-percentage-point increase in the proportion of migrant students in the classroom reduces local students' Chinese test scores by 1.06 points, which is equivalent to 0.11 standard deviations. Finally, as shown by Panel C, migrant peers have negative but relatively small effects on local students' English test scores.

When I examine possible migrant peer effects in terms of gender, the results in Panel A of Table 4 show that the negative migrant spillover effects are concentrated among male students. A ten-percentage-point increase in the proportion of migrant students in the classroom reduces local male students' math, Chinese, and English test scores by 0.16, 0.13, and 0.1 standard deviations, respectively. The results are consistent with the findings with immigrant peers (Diette and Oyelere, 2014). The possible explanations may be related to the argument that boys are more sensitive than girls to the learning environment with migrant peers in the classroom (Diette and Oyelere, 2014; Legewie and DiPrete, 2012), which I will explore in the next section.

In large cities such as Beijing and Shanghai, migrants face much more institutional barriers than in small or medium-sized cities

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[28] People may still be concerned that the relationship between migrant student composition and the academic performance of local students is confounded by the selective assignment of teachers to classes in response to the migrant composition. For instance, low-quality teachers may be assigned by school authorities to classes with larger proportions of migrant students. However, as Table A4 in the appendix shows, there is little association between the class-level migrant composition and teachers' characteristics, suggesting that this potentially important concern does not appear to manifest in this context.

[29] The average class-level migrant composition is 21.61% among the analysis sample.

Table 4
Heterogeneity in migrant peer effects by gender and by city scale.

	Math	Chinese	English
Panel A: Gender			
(a) Male			
Proportion of migrant peers in the class	−16.070***	−13.355**	−9.957*
	(5.157)	(5.207)	(5.145)
R²	0.077	0.064	0.085
Observations	3504	3505	3503
(b) Female			
Proportion of migrant peers in the class	−5.183	−7.941***	1.703
	(4.694)	(2.744)	(3.283)
R²	0.089	0.094	0.104
Observations	3354	3353	3356
Panel B: City scale			
(a) Large cities			
Proportion of migrant peers in the class	−19.999***	−13.909**	−11.199
	(4.940)	(5.691)	(6.871)
R²	0.071	0.136	0.136
Observations	1817	1816	1817
(b) Others			
Proportion of migrant peers in the class	−6.180	−8.849**	0.860
	(5.572)	(3.556)	(4.083)
R²	0.055	0.136	0.140
Observations	5041	5042	5042

Notes: All regressions control for individual characteristics including gender, age, ethnic minority status, and agricultural hukou status, household characteristics including parents' education levels, number of siblings, and dummy for low household income level, and grade-by-school fixed effects. Robust standard errors clustered at the school level are shown in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

and are more disadvantaged in terms of academic performance. When I divide the analysis sample into students in large cities and those in small or medium-sized cities, the results in Panel B of Table 4 show that migrant students have larger negative effects on the academic performance of local peers in large cities.[30] A ten-percentage-point increase in the class-level proportion of migrant students in schools located in large cities reduces local students' math, Chinese, and English test scores by 0.2, 0.14, and 0.11 standard deviations, respectively.

To sum up, the presence of migrant peers in the classroom has large and negative effects on the academic performance of local students, especially in the cases of math and Chinese test scores. Furthermore, the negative spillover effects from migrant peers are concentrated among male students and among those in large cities.

5.3. Robustness checks

In this subsection I first perform placebo regressions with students' previous academic performance in the primary school as outcomes to check whether the results pick up some unobserved within-grade-by-school confounders. Then I test the sensitivity of the main results (as shown in the final columns of Tables 3) to alternative samples or the alternative definition of the key explanatory variable – proportion of migrant peers in the class.

Students' previous academic performance at the sixth grade in the primary school should be weakly correlated with the presence of their current migrant peers because they are unlikely to be classmates in the primary school.[31] Otherwise, people may be concerned that the above estimates are due to the sorting of students into classes. As expected, the placebo test results in Panel A of Table 5 show that there is little association between current migrant composition in the classroom and students' self-reported learning difficulty degrees in the three compulsory subjects in the primary school, strengthening the interpretation that the estimates

[30] The CEPS survey data used in this paper covers 28 counties (or city districts), which are randomly selected out of 2870 counties (or city districts) in China. Because the survey team has not released any geographical information regarding the school location (except for three counties/districts in Shanghai), I construct an indicator that measures the degree of migrants' educational barriers in destination regions to proxy the city scale. Specifically, I construct this measure based on the proportion of parents reporting no permission to attend high school in destination cities. I divide the analysis sample into two subgroups: students in counties with high migration barriers, which are likely to belong to large cities (the fourth quartile in terms of the proportion, with the three Shanghai counties/districts belonging to this quartile) and students in the rest of 28 counties (the first three quartiles). I have also repeated the analysis using other subgroup definitions (for instance, the top 15% vs. the rest 85% in terms of the proportion) and obtained similar results. As suggested by the results in Table A5 of the Appendix, the negative migrant peer effects among students in large cities may come from the fact that migrant children tend to lag behind in their previous academic performance.

[31] In China the number of primary schools (191 thousand in 2015) is much larger than that of middle schools (52 thousand in 2015) and some parents may choose high-quality middle schools that are not located within the neighborhood. Therefore, it is unlikely that classmates in the primary school are also in the same classroom in the middle school.

Table 5
Robustness checks.

	Math	Chinese	English
Panel A: Placebo Tests with the Academic performance at Grade 6 as Outcomes			
Proportion of migrant peers in the class	−0.040	−0.003	−0.131
	(0.378)	(0.336)	(0.336)
R^2	0.155	0.119	0.233
Observations	6987	6972	6878
Panel B: Excluding Shanghai and Supplementary Samples			
Proportion of migrant peers in the class	−8.279	−10.169**	−0.169
	(5.705)	(4.068)	(4.326)
R^2	0.058	0.143	0.150
Observations	4597	4600	4598
Panel C: Excluding Private and Migrant Schools			
Proportion of migrant peers in the class	−10.309**	−9.481***	−2.511
	(4.426)	(3.251)	(3.616)
R^2	0.061	0.136	0.140
Observations	6233	6231	6234
Panel D: Excluding Schools with No Migrant Student			
Proportion of migrant peers in the class	−10.606**	−10.655***	−3.032
	(4.027)	(3.006)	(3.466)
R^2	0.059	0.135	0.138
Observations	6511	6510	6511
Panel E: Rural Migrant Peers instead of Migrant Peers			
Proportion of rural migrant peers in the class	−4.520	−7.006	1.518
	(6.616)	(5.796)	(5.025)
R^2	0.056	0.133	0.136
Observations	6858	6858	6859
Panel F: Rural Migrant Peers in Large Cities with High Migration Barriers			
Proportion of rural migrant peers in the class	−24.161***	−23.665	−13.443
	(6.872)	(14.071)	(15.001)
R^2	1817	1816	1817
Observations	−24.161***	−23.665	−13.443

Notes: The outcomes for Panel A are self-reported difficulty degrees of learning math, Chinese, or English when they attended the sixth grade in the primary school while the outcomes for Panels B-F are mid-term test scores in middle school. All regressions control for individual characteristics including gender, age, ethnic minority status, and agricultural hukou status, household characteristics including parents' education levels, number of siblings, and dummy for low household income level, and grade-by-school fixed effects. Robust standard errors clustered at the school level are shown in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

of this paper do not pick up the effect of other unobserved confounders.[32]

As Panel B shows, the estimation results remain almost unchanged when I exclude schools from Shanghai and supplementary sample regions.[33] Similarly, as shown in Panels C and D, the main results remain robust to excluding some special types of schools, such as migrant schools where the majority of students come from migrant families, and to excluding schools without any migrant student.

Finally, since China's rural-urban migration flows account for the majority of its ongoing internal migration flows (Duan et al., 2013; National Bureau of Statistics of China, 2017), it is interesting to study the effect of rural migrant peers on the academic performance of local students. As Panel E of Table 5 shows, the results are rather similar though the estimated coefficients are smaller in magnitude than those in Table 3. When I further limit the analysis to counties with high migration barriers, which usually belong to large cities, the results in Panel F of Table 5 indicate that the proportion of rural migrant peers has much larger negative effects on local students' academic performance.

Overall, the robustness check results show that the main results remain robust to various samples and the alternative definition of the key explanatory variable (class-level migrant composition). The results of placebo tests strengthen the interpretation that the main estimates indeed pick up the effect of class-level migrant composition, and not the effect of other unobserved confounders.

6. Mechanisms

To date, possibly due to data limitations, very few studies (Ohinata et al., 2013) have examined the mechanisms through which migrant peer effects operate. The CEPS provides me a unique opportunity to attempt to open the black box since it contains rich

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[32] I also do balancing tests for the three previous academic performance measures with the proportion of migrant children in a class as the outcome and find that they are balanced for the migrant composition in a class. Furthermore, the main results in Table 3 remain unchanged when I include these academic performance measures in the model. The results are available upon request.

[33] As mentioned in the Data Section, the CEPS oversampled the counties in large migrant destination regions like Shanghai and in large migrant-sending regions as the supplementary sample.

Table 6
Teachers' views: how do migrant students affect the learning environment?.
Source: Baseline wave of CEPS.

	Math teacher	Chinese teacher	English teacher
Panel A: Student Relationship			
No-migrant class	4.09	3.99	4.06
Class with a small number of migrant students	3.87	3.8	3.78
Class with more than 1/3 of students being migrants	3.61	3.5	3.42
Observations	138	147	143
Panel B: Class Discipline			
No-migrant class	3.98	3.84	3.93
Class with a small number of migrant students	3.83	3.69	3.68
Class with more than 1/3 of students being migrants	3.53	3.36	3.38
Observations	138	147	143
Panel C: Class Management with More Migrant Students			
More difficult (%)	26.92	35.8	32.91
Almost the same (%)	69.87	61.11	62.03
Less difficult (%)	3.21	3.09	5.06
Observations	156	162	158
Panel D: Class That a Teacher Prefers to Teach			
No-migrant class (%)	26.28	32.10	36.08
Class with a small number of migrant students (%)	19.23	24.07	18.99
Class with more than 1/3 of students being migrants (%)	7.69	1.23	3.16
Does not matter (%)	46.79	42.59	41.77
Observations	156	162	158
Panel E: Teaching Effectiveness			
No-migrant class	3.86	3.74	3.94
Class with a small number of migrant students	3.7	3.67	3.64
Class with more than 1/3 of students being migrants	3.33	3.5	3.17
Observations	138	147	143

Notes: Class discipline, teaching effectiveness, and student relationship in Panels A, B, and E are evaluated on a five-point Likert scale, with 1 being the worst and 5 being the best.

information on students' experiences at school, teachers' views on how migrant students influence the learning environment, and teachers' pedagogical practices. In this section I explore the following two possible channels: the change of learning environment and the adjustment of teachers' teaching behaviors due to the presence of migrant students in the classroom.

6.1. Learning environment

The CEPS collected teachers' evaluations of how migrant students affect the learning environment. Teachers were asked to evaluate the student relationship, class discipline, and teaching effectiveness for the three types of classes (no-migrant class, class with a small number of migrant students, and class with more than one third of students being migrants) separately on a five-point Likert scale (with 1 being the worst and 5 being the best). They were also inquired about how the presence of more migrant students affects the class management and about choosing the class they prefer to teach among classes with various proportions of migrant students.

As Table 6 indicates, more migrant students in the classroom may lead to worse student relationship and more problems with class discipline, and make class management more difficult.[34] Teachers prefer to teach classes with fewer migrant students and they think that the presence of migrant students may make teaching less effective. Taken together, from the perspective of teachers, more migrant students in the classroom may lead to a worse learning environment.[35]

The CEPS also asked students to evaluate their experiences in the classroom on a four-point scale (with 1 being "totally disagree" and 4 being "totally agree"): "The learning environment is good in my class". To provide further suggestive evidence on the learning environment channel, next I examine the effect of class-level migrant composition on this outcome. As shown by the first column of Table 7, local students are more likely to report a worse learning environment in classes with more migrant students, even after controlling for their academic performance. The estimates are relatively large in magnitude (compared to the means of outcomes in the first row of Table 7) although they are statistically insignificant at conventional levels. The final two columns of Table 7 suggest that boys are more likely than girls to report a worse learning environment, which is consistent with the main estimation results that local male students are more likely than girls to be negatively affected by the presence of migrant peers in the classroom.

Taken together, the above exercises provide suggestive evidence that migrant students negatively affect the academic

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[34] It should be noted that there are missing values on teachers' evaluations for about 30% of sampled teachers in my analysis. But as Table A6 of the Appendix shows, the missing data problem may be minor: the probability of missing values is unrelated to teachers' all observable individual characteristics.

[35] As expected, the negative migrant peer effects are larger in classes where teachers think the presence of migrant children has a negative effect on the learning environment. Please see the results in the Table A7 of the Appendix for more details. Thank the reviewer's suggestions on these results.

Table 7
Migrant composition and local students' evaluation of learning environment in the classroom.

	Total	Male	Female
Mean	3.206	3.136	3.280
Standard Deviation	0.875	0.914	0.824
Panel A: No Controls for Students' Current Academic Performance			
Proportion of migrant peers in the class	−0.206	−0.507	0.203
	(0.464)	(0.585)	(0.485)
R^2	6945	3565	3380
Observations	0.151	0.145	0.198
Panel B: Controls for Students' Current Academic Performance			
Proportion of migrant peers in the class	−0.246	−0.537	0.144
	(0.456)	(0.577)	(0.486)
R^2	6921	3550	3371
Observations	0.159	0.155	0.205

Notes: All regressions control for individual characteristics including gender, age, ethnic minority status, and agricultural hukou status, household characteristics including parents' education levels, number of siblings, and dummy for low household income level, and grade-by-school fixed effects. The controls for students' current academic performance are self-reported overall academic performance on a five-point scale. Robust standard errors clustered at the school level are shown in parentheses.

Table 8
Teachers' pedagogical practices in response to the migrant composition.

	Math teacher	Chinese teacher	English teacher
Panel A: Teaching Methods			
Lecturing	0.043	−0.984**	0.072
	(0.415)	(0.419)	(0.420)
Group discussion	−1.292***	−0.928*	0.499
	(0.402)	(0.496)	(0.665)
Interaction with students	−0.554	−0.846	−0.295
	(0.444)	(0.576)	(0.631)
Observations	208	212	210
Panel B: Teaching Media			
Multi-media projectors	−1.270**	−0.987	−0.958**
	(0.585)	(0.878)	(0.450)
Internet	−0.851	−0.119	−0.693
	(1.056)	(1.190)	(0.678)
Picture/model/poster	0.668	−2.525*	−1.081**
	(0.624)	(1.359)	(0.496)
Observations	208	212	210

Notes: The estimates in the table are the coefficients on the proportion of migrant students in the classroom for the 18 separate regressions. I control for grade-by-school fixed effects in all regressions. Robust standard errors are shown in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

performance of local students (especially boys) through worsening the learning environment, which is also consistent with Ohinata et al. (2013).

6.2. Teachers' pedagogical practices

Teachers' pedagogical practices in the classroom are significantly associated with students' learning outcomes (Araujo et al., 2016). For instance, teachers may adjust their pedagogical practices to meet the needs of migrant students who are not accustomed to school lives in destination regions, but this adjustment may impair the benefits of local students (Hunt, 2016). In this subsection I examine how the migrant student composition in the class affects teachers' pedagogical practices.

As Panel A of Table 8 indicates, in the classes with higher proportions of migrant students teachers are less likely to use the methods of group discussion and interaction with students, which are usually assumed to better improve students' cognitive abilities (Araujo et al., 2016).[36] On the other hand, the results in Panel B show that the presence of migrant students in the classroom has negative effects on the use of relatively advanced teaching media like multi-media projector, Internet, and pictures, models, or

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[36] The effect of migrant composition on the lecturing method is ambiguous, with a large negative effect for Chinese teachers and positive effects for math and English teachers. But according to the qualitative interview information from Table 9, Chinese teachers state that lecturing is more appropriate for classes with larger migrant proportions.

Table 9
Teachers' views: migrant composition and pedagogical practices.
Source: Baseline wave of CEPS.

	Math teacher	Chinese teacher	English teacher
Panel A: No-Migrant Class			
Lecturing (%)	17.73	15.03	17.45
Group discussion (%)	14.89	15.03	17.45
Student-teacher interaction (%)	67.38	69.93	65.1
Observations	141	153	149
Panel B: Class with a Small Number of Migrant Students			
Lecturing (%)	18.44	11.76	16.11
Group discussion (%)	25.53	32.03	41.61
Student-teacher interaction (%)	56.03	56.21	42.28
Observations	141	153	149
Panel C: Class with More than 1/3 of Students Being Migrants			
Lecturing (%)	33.33	26.14	40.94
Group discussion (%)	14.18	22.88	18.79
Student-teacher interaction (%)	52.48	50.98	40.27
Observations	141	153	149

posters, which are important for teaching effectiveness. The above results are consistent with the findings from Lavy et al. (2012) that a higher proportion of low-ability students may lead teachers to focus more on requiring students to memorize materials rather than on real comprehension.

Finally, the CEPS asked teachers to choose which teaching method (lecturing, group discussion, or student-teacher interaction) is best suited for the three types of classes (no-migrant class, class with a small number of migrant students, and class with more than one third of students being migrants) separately. As Table 9 shows, teachers agreed that classes with more migrant students should be taught more frequently with the traditional lecturing method and less frequently with group discussion and student-teacher interaction, which is overall consistent with the results in Table 8.

To summarize, both the descriptive and regression exercises provide suggestive evidence that migrant peers may negatively affect the academic performance of local students through the worsening of learning environment or through the adjustment of teachers' pedagogical practices to meet the needs of migrant students in the classroom.

7. Conclusions

This paper examines spillover effects of internal migrant peers on the academic performance of local students using the baseline wave of China Education Panel Survey (CEPS), a nationally representative survey administered to middle school students in China. To the best of my knowledge, this study is the first to examine such spillover effects of "internal" migrant peers in a developing country and is also among the very few studies that have examined the underlying mechanisms of migrant peer effects.

By exploiting the random assignment of students into classrooms within the same grade of a school, I find that the presence of migrant peers in the classroom has large and negative effects on the academic performance of local students and the negative migrant peer effects are concentrated among male students and among local students in large cities with large migration barriers. For instance, a ten-percentage-point increase in the proportion of migrant students in the classroom reduces math test scores of local students as a whole by 0.11 standard deviations, those of boys by 0.16 standard deviations, and those of local students in large cities by 0.2 standard deviations.

Given the rich information contained in the CEPS, I can shed some light on the underlying mechanisms. One possible channel is related to the worsening of learning environment, which is suggested by local students' at-school experiences in response to the migrant composition and teachers' evaluations of how migrant students affect the learning environment. Another channel is related to the adjustment of teachers' teaching behaviors in response to the migrant composition. Teachers hold group discussion or interact with students less frequently and are less likely to use advanced teaching media in the classrooms with more migrant students, but this adjustment may impair the benefits of local students.

The findings of this paper have important policy implications not only in the context of China, but also for other countries, especially those developing countries that have been also experiencing massive internal migration flows. While it is important that local governments should reduce institutional barriers to the education of migrant children and help them be better assimilated into local urban lives, attention should also be paid to addressing possible adverse peer effects on the academic performance of local students (for instance, allocating more resources to schools with high proportions of migrant students or helping teachers develop their abilities to teach classes with students from different backgrounds) when designing migration policies, which have been hotly debated in China's public media news and in the literature regarding international migration.

Acknowledgments

Appendix

Table A1
Class size and proportion of migrant children in a class.
Source: Baseline wave of CEPS.

Class size	Number of classes	Proportion of migrant children
< = 20	7	32.51%
(20, 30]	35	33.77%
(30, 40]	49	30.05%
(40, 50]	60	26.70%
(50, 60]	37	13.71%
> = 60	27	8.10%

Table A2
Schools with random assignment rules vs. schools without.
Source: Baseline wave of CEPS.

	Schools with random assignment rules	Schools without random assignment rules
Panel A: School location		
Inner city areas of cities or county seats (%)	53.49	43.95
Suburbs of cities or county seats (%)	17.21	11.66
Areas other than cities or county seats (%)	29.30	45.39
Panel B: School quality		
Lowest quality within the county (%)	0.00	1.83
Lower-middle quality within the county (%)	6.51	7.31
Middle quality within the county (%)	13.49	12.79
Upper-middle quality within the county (%)	59.53	59.82
Highest quality within the county (%)	20.47	18.26

Table A3
Balancing tests for all local students in the CEPS survey.

	No controls	Grade-by-school fixed effects
Panel A: Student Characteristics		
Male	0.031	0.085
	(0.030)	(0.083)
Age	−1.270***	0.257**
	(0.252)	(0.130)
Minority	−0.149	−0.005
	(0.116)	(0.030)
Agricultural hukou	−0.865***	−0.035
	(0.137)	(0.103)
Panel B: Household Characteristics		
Father's years of education	3.207***	−1.692**
	(0.892)	(0.657)
Father having at least high school education	0.498***	−0.252**
	(0.127)	(0.097)
Mother's years of education	3.910***	−1.285*
	(1.103)	(0.747)
Mother having at least high school education	0.476***	−0.122
	(0.126)	(0.089)
Number of siblings	−1.016***	0.037
	(0.259)	(0.135)
Dummy for low household income	−0.430***	0.038
	(0.083)	(0.066)

Notes: The numbers are the estimated coefficients on the proportion of migrant students in the classroom for 20 separate regressions, with ten background variables as the outcomes and the two specifications being no controls and controlling for grade-by-school fixed effects. Robust standard errors clustered at the school level are shown in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

Table A4
Migrant composition and teachers' characteristics.

	Math teacher	Chinese teacher	English teacher	Homeroom teacher
Male	0.045	0.020	0.035	0.016
	(0.035)	(0.048)	(0.034)	(0.014)
Age	0.001	0.012*	−0.008**	0.006
	(0.003)	(0.007)	(0.003)	(0.004)
Having at least full-time university education	0.063	−0.067	−0.003	0.037
	(0.055)	(0.063)	(0.034)	(0.046)
Years of teaching experience	−0.001	−0.006	0.004	−0.000
	(0.002)	(0.005)	(0.003)	(0.002)
Having a senior professional title	0.031	−0.078	0.016	0.004
	(0.073)	(0.050)	(0.030)	(0.042)
Joint significance tests: F-statistics (p-values)	1.05(0.40)	0.75(0.59)	1.56(0.18)	1.11(0.36)
R^2	0.929	0.934	0.918	0.931
Observations	207	207	202	214

Notes: Each column represents the estimation results of a regression with the proportion of migrant students in the class as the outcome. I control for grade-by-school fixed effects in all the three regressions. Robust standard errors are shown in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

Table A5
Previous academic performance of students in large cities.
Source: Baseline wave of CEPS.

	All students	Local students	Migrant students	Difference
Difficulty degree of learning in grade 6				
Math	3.045	3.061	3.006	0.055
Chinese	3.202	3.208	3.185	0.023
English	3.009	3.052	2.899	0.153***
Observations	2553	1830	723	

Table A6
Possibility of missing values and teachers' characteristics.

	Math teacher	Chinese teacher	English teacher
Male	0.132	0.129	0.116
	(0.137)	(0.245)	(0.232)
Age	0.002	−0.002	0.002
	(0.019)	(0.016)	(0.021)
Having at least full-time university education	0.281*	0.031	0.190
	(0.145)	(0.178)	(0.126)
Years of teaching experience	−0.002	0.001	0.003
	(0.017)	(0.014)	(0.010)
Having a senior professional title	0.049	−0.103	0.055
	(0.141)	(0.214)	(0.155)
Joint significance tests: F-statistics (p-values)	1.05(0.40)	0.23(0.95)	0.57(0.72)
R^2	0.661	0.608	0.751
Observations	207	207	202

Notes: Each column represents the estimation results of a regression with the outcome being the dummy for having missing values on teachers' views on how migrant students affect the learning environment (as documented in Panels A, B, and E of Table 6). I control for grade-by-school fixed effects in all the three regressions. Robust standard errors are shown in parentheses. * significant at 10 percent level.
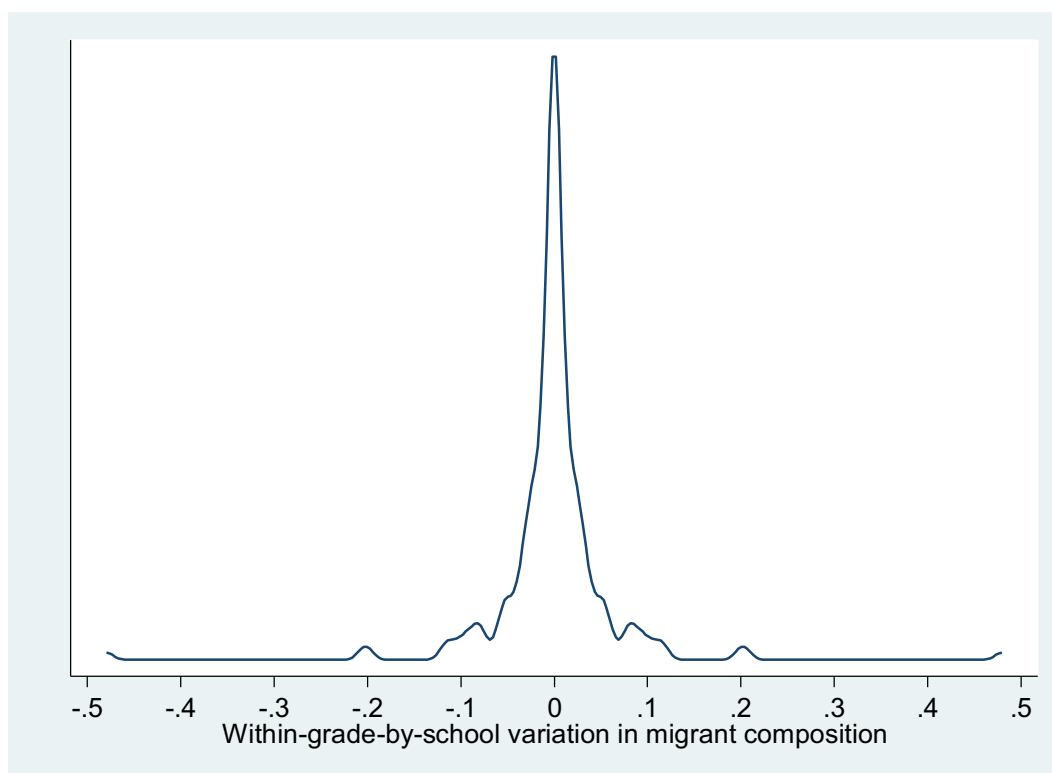
Fig. A1. The Distribution of within-grade-by-school migrant composition.

Table A7
Heterogeneity in migrant peer effects: whether migrants negatively affect class environment in terms of teachers' views.

	Math	Chinese	English
Panel A: Negative Teachers' Views			
Proportion of migrant peers in the class	− 22.361*	− 10.417	1.174
	(12.002)	(9.032)	(2.605)
R^2	0.070	0.170	0.178
Observations	1189	1821	1601
Panel B: Not Negative Teachers' Views			
Proportion of migrant peers in the class	− 13.725***	− 8.956**	− 3.531
	(4.957)	(3.825)	(4.151)
R^2	0.062	0.129	0.134
Observations	5669	5037	5258

Notes: All regressions control for individual characteristics including gender, age, ethnic minority status, and agricultural hukou status, household characteristics including parents' education levels, number of siblings, and dummy for low household income level, and grade-by-school fixed effects. Robust standard errors clustered at the school level are shown in parentheses. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

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