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The Education Gap of China's Migrant Children and Rural Counterparts

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ABSTRACT *Rural residents in China today face at least two key decisions: a) where to live and work; and b) where to send their children to school. In this paper we study the second decision: should a rural parent send their child to a public rural school or have him or her attend a private migrant school in the city. While there is an existing literature on the impact of this decision on student academic performance, one of the main shortcomings of current studies is that the data that are used to analyse this issue are not fully comparable. To fill the gap, we collected data on the educational performance of both migrant students who were born in and come from specific source communities (prefecture) in rural China and students who are in rural public schools in the same source communities. Specifically, the dataset facilitates our effort to measure and identity the academic gap between the students in private migrant schools in Shanghai and Suzhou and those in the public rural schools in Anhui. We also seek to identify different sources of the gap, including selection effects and observable school quality effects. According to the results of the analysis, there is a large gap. Students in public rural schools outperform students in private migrant schools by more than one standard deviation (SD). We found that selection effects only account for a small part of this gap. Both school facility effects and teacher effects explain the achievement gap of the students from the two types of schools, although these effects occur in opposite directions.*

1. Introduction

In China, as in the rest of the world, migration not only imparts significant benefits to individuals through the higher returns to work, it can also have strong and transformative impacts on both the destination communities in cities and the source communities from where the migrants have come (Du, Park, & Wang, 2005; Gibson & McKenzie, 2012; Taylor, Rozelle, & de Brauw, 2003). Unfortunately, the same argument cannot always be extended to other family members, particularly the children of migrants. When rural residents are trying to make the decision to move to the city they need to consider that there are many stresses that have to be born by family members. In particular, researchers internationally have documented the downside impacts of migration on the children of migrants (Lahaie, Hayes, Piper, & Heymann, 2009; Spera, 2005). One of the most basic decisions is whether their children should live and go to schools in their own hometowns in public rural schools or attend schools in the city. Parental migration has been shown to affect the level of schooling that the children of migrants attain (Liang & Chen, 2007; Mansuri, 2006; McKenzie & Rapoport, 2007). Other research has documented that the decision of parents to migrate or not is also correlated with poorer school performance (McKenzie & Rapoport, 2011).

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In the case of China the potential impact of the decision of parents to migrate may be particularly large – due to China's unique institutional and policy environment (Chan & Zhang, 1999). In particular, due to the constraints of the *hukou* system, migrant children are not unconditionally entitled to enrol in urban public schools (Lai et al., 2014). Although policies have waxed and waned over time regarding how welcome migrant children are to enrol in urban public schools, the fact is that a large share of migrant children are not able to attend public schools in many of China's large cities (Chen & Feng, 2013; Lai et al., 2014).

As a result of this two-tiered residency system, parents in rural China have to make two sets of intertwined decisions. First, they need to decide to migrate or not. When this decision has been made for those that decide not to migrate, the schooling decision has essentially already been made. The children of non-migrants will attend rural public schools. Migrant parents, however, need to make one more decision for the education of their children: leave their children in the care of a relative and have them attend rural public schools or take them into the city and have them attend school in the city. When migrant parents have made the decision to bring their child to the city, the next decision (which is often out of their control) is to put migrant children into urban public schools or to enrol them into private, for-profit schools that have emerged for the very reason of educating the children of migrants (henceforth, *private migrant schools*). Many authors have written about migrant children and the conditions of their schools (Chen & Feng, 2013; Goodburn, 2009; Lai et al., 2014). Although facilities in cities are not always poor, tuition can be high. Teacher turnover can be high. There is little, if any, regulation or oversight by urban education officials. In general, there is reason to believe that quality of eduction in private migrant schools may be low.

So, what is the effect of the choice that migrants make on the education/learning of their children? Ex-ante, there are potentially offsetting benefits and costs of the decision to send one's children to either type of schools, private migrant school or public rural school. To carry out the benefit-cost analysis, parents must compare the quality of education in public rural schools and private migrant schools. Rural students go to regulated public rural schools where recent central government support have been made to support the quality of teaching especially (Zhao, Yu, Wang, & Glauben, 2014). Public rural school facilities, while improving, are still mostly paid for by the local government, which often are fiscally constrained. In contrast, with little (or no) investment from the government, the level of teaching quality – from many different dimensions – may be lower in migrant schools. However, children in the city live with their parents and their parents (mostly) have higher incomes (Knight & Song, 2003). The additional investment that can be financed by the higher levels of income may be associated with higher levels of academic performance of the migrant children (Antman, 2012).

In short, then, there are sharp trade offs in deciding schooling and employment/residency decisions. Migrant children are in families with relatively high income and also live with their parents. However, they must attend private migrant schools. If parents decide to send their child to rural public schools, the trade-offs differ with whether they decide to work as a migrant and live away from home or if they live at home and farm. In the case of those children studying in public rural schools, the migrant parents will have higher earnings but will be able to provide less care. In the case of children living with their parents in rural areas, stay-at-home-and-farm parents will have lower earnings but will be able to provide more care.

Perhaps because the trade-offs are complicated, the existing literature has not reached a consensus on whether the academic performance of children is higher when they attend private migrant schools or public rural schools. One set of researchers have generally found that the school quality of private migrant schools is low and that this lowers the quality of education of migrant children (Chen & Feng, 2013; Chen, Huang, Rozelle, Shi, & Zhang, 2009). In contrast, there are studies (for example, Lai et al., 2014) that find evidence showing that students in private migrant schools outperform those in rural public schools.

While the existing studies are of interest and shed light on the effect of having children attend private migrant schools compared to having them attend public rural schools, there are certain limitations. Most of the studies are qualitative and are not able to rigorously assess the relative quality of having ones child educated in a private migrant school (Han, 2004; Kwong, 2004). Perhaps most

salient, in some of the current studies that do use econometric approaches (for example, Chen & Feng, 2013; Chen et al., 2009; Lai et al., 2014), the research teams compare the test scores of migrant students who come from one part of the country (for example, most migrants students in Beijing private migrant schools are from Henan or Northeast China) and the test scores of students that attend public rural schools from a completely different part of the country (for example, Shaanxi or Gansu) (Lai et al., 2014).

The overall goal of our study is to present evidence on the academic performance of migrant students, compare their performance with students from public rural schools and explore the determinants of migrant student/public rural student performance. As discussed above, one of the most important reasons for the absence of empirical evidence on migrant student performance is lack of comparable quantitative data on students from private migrant schools and public rural schools. In our study, we collected data on (and gave standardised math tests to) students in 87 Shanghai and Suzhou private migrant schools. After identifying the source communities of these students (the prefectures from where their families came, henceforth called the study's *core prefectures*), we also collected data on (and gave standardised math tests to) students in 30 public rural schools (in the core prefectures in Anhui province). The data from these matched public rural and private migrant schools are the basis of the analysis of this paper. Hence, the main contribution of our study is that we compare the educational performance of migrant students who were born in and come from a certain part of the country with the educational performance of students who are in public rural schools in that exact same part of the country.

To meet our goal, the rest of the paper is organised as follows. In the next section, we describe the data sets that facilitate this analysis and explain the empirical strategies that we use to examine the main research questions. In the third section we report on the results of the empirical analysis. The last section summarises the findings and concludes.

2. Research methodology

2.1. Data

We used the following sampling strategy to collect the data used in the study. We began the study by conducting a canvas-like survey to choose a sample of schools in two suburban areas around central Shanghai – Suzhou, Jiangsu; and Shanghai's outlying districts and counties. Unlike public urban and rural schools, however, no official list of private migrant schools is available in Shanghai or Suzhou. To collect a comprehensive list of private migrant schools in Shanghai and Suzhou, we contacted all educational and research institutes and non-profit organisations in the two cities that might have contact information for private migrant schools in Shanghai and Suzhou. We then called each school to confirm that the schools were still operating. By proceeding this way, we believe that we were able to establish a representative dataset of private migrant schools in Shanghai and Suzhou – certainly more complete than any other existing list. A total of 87 schools were on our list. All private migrant schools in that sampling frame were part of our overall sample.

Once we entered the private migrant schools, we randomly chose one class in fifth grade. We chose fifth grade students to be comparable to other research efforts that have been studying this same general topic. All of the students in that fifth grade class form the migrant student part of our sample. In total there were 3755 migrant students in 87 fifth grade classes in 87 migrant schools. All students were the children of migrants; there were no children of local urban residents.

In the initial canvas survey that we conducted, we asked students to identify the community (by prefecture name) that they (or their parents) came from. Of the 3755 fifth graders in the migrant school sample, around a quarter of the students (914 of them or 24% of the sample) came from three prefectures in Anhui Province: Fuyang, Lu'an and Bozhou. In the rest of the paper we will call these the *three core study areas*. This is an attempt to minimise the importance of unobservables, and thus we collected a sample of rural students that were exactly from the same source community as the migrants' children. Our hope was that more of the unobservables (for example, norms, cultural

practices, view on education, parenting practices, and so forth) would be the same and that estimates using the samples would provide unbiased estimates of the true effect on learning of taking children into migrant communities and having them attend migrant schools.

The second part of the sampling protocol was developed to sample schools and students from the three core study areas.[1] To obtain our sample, we chose our sample counties in the three prefectures. Specifically, we chose two counties in Fuyang and Lu'an prefectures and one county in Bozhou prefecture. The counties were randomly chosen from the list of counties in each prefecture. In each of the sampled county, the survey team obtained a list of all schools. Then we narrowed this list to the elementary schools that offered six full grades of schooling. From this list, we randomly selected six schools in each county for inclusion in our sample. In total, we selected 30 (five counties by six schools/county) rural public schools.

Once the rural public schools were chosen, we proceeded to create a sample of students. Like the migrant schools, in each of the schools we focused on all of the students in one randomly chosen fifth grade class. A total of 1516 students are included in our sample of rural public schools in three prefectures in Anhui province. On average, there were 50 fifth graders per class (school).

Having a rural sample like this, will allow us to shed some light on the question of the effect on a child's human capital if his/her parents take him/her to the city for schooling rather than leaving him/her behind with a relative in the home village and having the child attend a rural public school. According to discussions with educators in each of the three core Anhui prefectures in our study, around half (50%) of children in the rural public schools in the sample counties were left behind children. This means that if we do see that there is a difference between schooling outcomes in rural public schools and private migrant schools, then this may be in part due to the decision of parents to take their child to the city for schooling or leaving them behind.

2.1.1. Data collection. After the sample schools and students were chosen (in both the migrant and rural study areas), we then proceeded with the data collection. In order to make the assessments of levels of learning comparable, we carried out the data collection work in both areas during the exact same two-week time period. The timing was critical because we wanted to make sure that the students in both the migrant and rural public school samples were in the same points of time in their schooling careers (in terms of years, months, weeks of schooling).

In each of the sample migrant and rural schools, teams of enumerators carried out the survey that consisted of three blocks. In each team one enumerator conducted a school-level survey about the school's facilities and information about the quality of the teaching staff. In terms of facilities, the enumerators recorded information on whether or not there were computer rooms, libraries, exercise equipment and the like. Furthermore, we also include the total number of teacher and class size proxied by the number of the students to explore the impact of school resources on the academic performance of the students. When asking questions about teacher quality, we included questions about the share of female teachers; shares of teachers that had achieved different formal ranks in the Chinese assessment system; share of formal teacher credentials; the amount of experience in teaching; the nature of the formal education of teachers; and so forth. The other enumerators executed a student survey that collected information on student characteristics (gender, whether they are the single child in the family, and so forth,) and family characteristics (family size, the levels of education of the parents and so forth).

After the individual interviews were over, the enumeration team then carried out grade-specific, standardised mathematics tests that were designed to be appropriate for students in the fifth grade. As stated above, the exact same tests were given during the same week in both the private migrant schools and the public rural schools. The tests were administered on printed-paper. To design the test, local educators assisted with the selection of questions from items developed for the Trends in International Mathematics and Science Study.[2] The examination was timed (25 minutes) and proctored by the enumerators at each school. Mathematics (as opposed to Chinese language) was chosen for testing to reduce the effect of home learning on performance and to better focus on classroom learning. *For analysis, we normalise scores by taking the entire set of test scores (including those of both rural*

Table 1. The nature of the datasets

Dataset	Nature of the samples	Number of students				
			Migrant schools			Rural schools
		Total	Shanghai+Suzhou	Shanghai	Suzhou	
1	Whole sample	5271	3755	2683	1072	1516
2	Those originated from Anhui and those in three prefectures, Anhui	3067	1551	1175	376	1516
3	Those originated from and in three prefectures, Anhui	2430	914	726	188	1516

public students and private migrant students) and normalised them together, by subtracting the overall mean and dividing by the overall standard deviation. This, of course, maintains the relative positions/rankings of the test scores of all of the rural public students and private migrant students, while transforming the variable into a form that is more readily interpretable (that is, in SDs). The exams also were graded by our research team.

Using the data that we collected, the team constructed three datasets, each based on the origin (or source community) of the migrant students. Dataset 1 used all of the observations in both the migrant schools (3755 students) and in the rural schools (1516 students). In other words, all migrant students were included, without regard to their source community. Dataset 2 is the same as Dataset 1 except that the only migrant students in the dataset were those from Anhui (1551 students). Dataset 3 was the same as Dataset 1 except that only migrant students were those from the three core study regions (914 students). A summary of the three datasets is included in Table 1.

2.2. Empirical strategy

We use a two-step approach to compare educational performance in migrant schools to that in rural public schools. In the first step we conduct simple comparisons of test scores – migrant students versus public rural students. We also descriptively explore the correlates of the differences in academic performance of students between students from migrant schools and rural public schools. Note that in the case of the descriptive analysis (as well as the multivariate analysis – described below), we use (for comparison purposes) all three datasets.

In the second step we use multivariate regression analysis to examine the rural-migrant student academic achievement gap and seek to identify the determinants/correlates of this gap. The regression analysis itself has two steps. Initially, we estimate the raw rural-migrant student achievement gap without controlling for any student or school characteristics that might affect student performance. The model is as follows:

$$y_{is} = \alpha + \beta mig_s + \varepsilon_{is} \tag{1}$$

where y_{is} is the standardised math test score of student i in school s, and mig_s is a dummy variable equal to one for migrant school students and zero for rural public students. By construction, the coefficient of the dummy variable mig_s, β is equal to the unconditional difference in mean test scores between migrant school students and rural public school students in Anhui.

After estimating the size of the achievement gap, we then seek to analyse the determinants of the gap. There are three possible sources of the achievement gap that we are interested in identifying. First, there may be what we call a selection effect. Migrant parents may select children who have better (or worse) academic potential to take to the destination of migration. It also may be that parents who are better able to provide a favourable study/home environment in Shanghai or Suzhou are those that are more likely to bring their children along with them. Therefore, students in migrant and rural

schools could have systematically different individual and family backgrounds which could be creating part of any observed rural-migrant student achievement gap.

The second and third possible reasons for the achievement gap between rural-migrant students may be differences in quality of the school facilities and the differences in the quality of the teaching resources. Migrant schools in Shanghai and Suzhou and rural public schools in Anhui might differ in terms of school facilities and teacher quality. We term these two effects the school facilities and teaching resources effects.

To empirically assess whether the selection effect or the school effects (or both) can explain the observable achievement gap between rural and migrant schools students, we extend our basic model in Equation (1) by adding additional control variables that we hope will be able to capture (at least the part of) the selection effect and school effects due to observable school facilities and teaching factors. The model is extended as

$$y_{is} = \alpha + \beta' mig_s + \gamma X_i + \varphi S_s + \theta T_s + \varepsilon_{isc} \tag{2}$$

where X_i is a vector of the student and family characteristics of student I, S_s is a vector of school facility measures, T_s is a vector of the characteristics of the teachers in school s.

The student and family characteristics vector (X_i) is comprised of a set of factors designed to capture the part of selection effect that is due to observable student and family characteristics. Factors in X_i include gender, a dummy variable which is equal to one if the student is an only child, family size, the education level of each students father, and the education level of each student's mother.

The characteristics of teachers (T_s) includes the characteristics of the teacher in school s such as the teacher's gender, education experience/quality, as measured by dummy variables indicating the professional rank of the teacher, and the whether the teacher was a formally credentialed teacher. We also include the education attainment and teaching experiences of the teacher head in class c.

The indicators of school resources $(S_{s'})$ to represent school quality include the age of the school and the availability of certain facilities. Specifically, we asked if the school had a computer room; if the school has a library/reading room; and if the school had a formal after school tutoring programme. Furthermore, we also include the class size and the number of teachers in the school – a proxy for the size of the school to evaluate the impact of school resources on the achievement gap between the migrant students and rural students.

In Equation (2) β' represents the rural-migrant achievement gap conditional on rural and migrant students having the same student and family characteristics (measured by X_i) and attending the schools of the same quality (measured by$T$ and S_s). In other words, β' measures the remaining part of the rural-migrant student achievement gap that cannot be attributed to either the observable part of the selection effect (due to differences in observable student and family characteristics, X_i) or the school effect (due to differences in observable teacher characteristics (T_s) and school resources S_s).

If there is a significant variation in magnitude from β (the unconditional achievement gap from Equation [1]) to β' (the achievement gap conditional on the selection effect and school effect from Equation [2]), we can infer that the rural-migrant student achievement gap can be at least in part explained by the selection effect and/or the school. In other words, the rural-migrant student achievement gap is driven either by the differences in student and family characteristics or by the differences in school facilities and/or teacher characteristics between rural and migrant schools.

If after controlling for the observable factors (X_i, T_s, and S_s), the conditional achievement gap, β', remains statistically significant, there could be several explanations. First, it could be that besides the selection effect and school effect brought about by the observable factors included in the model, other unobservable factors also contribute significantly to the achievement gap through the selection effect, the school effect or other channels such as differences in living conditions between rural and urban areas. For example, it may be that even after holding observable teaching characteristics constant, teachers in private migrant schools do not teach very hard due to the fact that they are not being formally assessed (there is no assessment of teachers in private migrant schools) and/or due to the fact that most teachers in private migrant schools do not have a commitment to the students, given the high

rate of turnover in these schools. A second possible explanation might be that the selection effect (captured by factors in X_i),the teacher (factors in T_s) and the school effect (S_s) affect the rural-migrant student achievement gap in opposite directions and cancel each other out, thus keeping the estimated achievement gap unchanged after controlling for the different effects.

While we will discuss the first explanation more in the conclusion (since there is really little additional analysis that can be done in this regard), in order to explore this second explanation, as well as to examine how the selection effect and the facilities/teaching effects each affects the rural-migrant student achievement gap, we control for the student and family characteristics (X_i) and indicators of teacher(T_s) and school quality (and S_s) one set at a time in two additional models. The consequent change in the estimated achievement gap reveals how each of the two effects (self-selection and school quality) influences the rural-migrant student achievement gap. In order to gauge the statistical significance of each set of factors X_i and (T, S_s) in determining student performance, we also conduct F tests of joint significance of the elements in each set of parameter vectors γ,θ and φ respectively.

3. Results

3.1. Descriptive analysis

The descriptive statistics from our study clearly show migrant students performed significantly worse than students in public rural schools (Table 2). This is true regardless of which of the three datasets that we used. According to our data, rural public students scored an average of 0.79 standard deviations (or *SDs*) on the standardised math test (row 1). When comparing to migrant school students in general (in dataset 1), the average test score was −0.33 SDs. The difference in the two sets of scores (rural public versus migrant students) was 1.12 SDs. In the education literature, this degree of difference is considered fairly large (Koedel & Betts, 2007; Rivkin et al., 2005; Rockoff, 2004).

We also calculated the rural-migrant student achievement gap by restricting our sample to students from Anhui province (using dataset 2) and by restricting our sample to students from the three core study areas (using dataset 3). According to our results, there were similarly wide gaps. Using dataset 2, rural public school students outscored migrant students by 1.12 SDs (Table 2, row 2). Using dataset 3, the gap was 1.15 SDs in favour of students from the three core study areas (row 3).

Table 2. Descriptive statistics of math score, student and family characteristics

	Rural students	Migrant students	Difference b/w migrant and rural students
Standardised math score			
Dataset 1	0.79	−0.33	0.00***
Dataset 2	0.79	−0.33	0.00***
Dataset 3	0.79	−0.36	0.00***
Student and family characteristics			
Gender (1 = male; 0 = female)	0.51	0.55	0.15
If single child in the family (1 = yes; 0 = no)	0.11	0.11	0.71
Family size (persons)	4.33	4.72	0.00***
Education attainment of father (1 = high school and above; 0 otherwise)	0.60	0.56	0.06*
Education attainment of mother (1 = high school and above; 0 otherwise)	0.44	0.37	0.00***
Observations in dataset 3	1516	914	

Sources: Authors' own survey.
Notes: ***, ** and * significant at 1 per cent, 5 per cent and 10 per cent, respectively.

3.2. Self-selection and teacher and school quality

3.2.1. Self-selection effects. Using our data to examine the different sources of the rural-migrant student achievement gap, we find that rural students have significantly stronger family backgrounds than migrant students, indicating that self-selection might be one reason for the observed rural-migrant student achievement gap (Table 2). From dataset 3, we find that migrant students come from bigger families (the average family size 4.69) than rural students (4.33). In addition, the percentage of public rural students whose mothers finished high school (or above) was 44 per cent which is shown to be significantly higher than the education levels of the mothers of migrant students (37%). There are no other differences in the other student/family characteristics. Summary statistics for those in dataset 1 and dataset 2 also demonstrate patterns consistent with those in dataset 3 (see Appendix Table A1).

So how to interpret these finding? To the extent that students from smaller families and households in which the mother has a higher level of education provide a more favourable environment for students to thrive in schools, we would expect students from public rural schools to be doing better (that is, the selection effect of migrants is negative in terms of learning – or gap increasing). However, it is also important to note that, while we do observe statistically significant differences between the characteristics of students (and families) of private migrant schools and public rural schools, the absolute magnitudes of the differences are not large. So, in summary, while part of the observed achievement gap may be due to self selection, at least according to our observable statistics, it might be expected that this can not explain all of the gap.

3.2.2. School quality effects.

3.2.2.1. Facilities. In contrast, our data suggest that the quality of facilities actually works in favour of students from private migrant schools. According to data comparing the quality of private migrant school facilities with those of public rural schools, private migrant schools are newer (Table 3, row 1). Specifically, private migrant schools have been operating for only 11 years (on average) while public rural schools have been around for 41 years. In terms of the quality of facilities, private migrant schools also dominate (rows 2–4). More than 80 per cent and almost all (98%) of the private migrant schools in our sample have reading and computer rooms. In contrast, in public rural schools, only 57 per cent (27%) of the rural schools have reading rooms (computer rooms). The percentage of private migrant schools with computer tutoring (93%) is also higher than public rural schools (57%).

3.2.2.2. School size and class size. On average, the school size proxied by the number of teachers is larger for private migrant schools than public rural school (more than 26 teachers). On average, there are more than 50 students in public rural schools and 45 students in private migrant schools. The differences of school size and class size are statistically significant between private migrant schools and public rural schools.

Table 3. Descriptive statistics of school characteristics

	Rural school	Migrant School	Difference b/w migrant and rural school
Age of the school (year)	41.60	11.06	0.00***
The school has reading room (1 = yes; 0 = no)	0.57	0.80	0.00***
The school has computer class (1 = yes; 0 = no)	0.27	0.98	0.00***
The school has computer tutoring (1 = yes; 0 = no)	0.57	0.93	0.00***
Number of teachers (no.)	26.00	35.17	0.01***
Class size (number of student in a class)	50.71	45.49	0.01***
No. of observations	30	87	

Source: Authors' own survey.
Notes: ***, ** and * significant at 1 per cent, 5 per cent and 10 per cent, respectively.

Table 4. Descriptive statistics of school teacher characteristics

	Rural school	Migrant School	Difference b/w migrant and rural school
The characteristics of school teacher			
Female teacher share (%)	0.43	0.65	0.00***
Share of rank III (%)	0.49	0.12	0.00***
Share of rank II (%)	0.32	0.17	0.00***
Share of rank I (%)	0.09	0.15	0.20
Share of formal teacher credentials (%)	1.00	0.34	0.00***
Education attainment of teacher head (1 = with college degree and above; 0 otherwise)	1.00	0.99	0.56
Teaching experience of teacher head (year)	16.87	11.26	0.02***
No. of observations	30	87	

Source: Authors' own survey.
Notes: ***, ** and * significant at 1 per cent, 5 per cent and 10 per cent, respectively.

3.2.3. Teacher characteristics. The quality of teaching, in contrast to physical facilities, clearly favours public rural schools (Table 4). According to data comparing the teacher resources in private migrant schools and public rural schools, in public rural schools, 49 per cent of teachers are Rank III teachers. This means that the teachers have had experience and have been recognised by intensive annual assessments as being top quality teachers. In contrast, only 12 per cent of teachers in private migrant schools are Rank III. The same is true of Rank II teachers. In public rural schools, 32 per cent of teachers are Rank II; however, in private migrant schools only 17 per cent of teachers are Rank II. Teachers in private migrant schools also are less likely to be credentialed. In fact, while all teachers (100%) in public rural schools have formal teaching credentials, only 35 per cent of teachers in private migrant schools are credentialed. The teacher head in class *c* in public rural schools has, on average, around 17 years of teaching experience while those in private migrant schools have roughly 11 years of teaching experience. It is not surprising that almost all of the teacher heads either in public rural schools or private migrant schools finished college studies.

3.3. Multivariate analysis

The results of our multivariate analysis are consistent with the descriptive analysis (Table 5). When running the simple model from Equation (1), rural students significantly outperformed migrant students by 1.11 points on the standardised math test for dataset 1 (Panel A, column 1, row 1). When restricting the sample of migrant students to those from Anhui (dataset 2) or to those from the three core study areas (dataset 3), the academic gaps are similarly wide (Table 5, Panels B and C). Compared to the counterparts in rural areas, the measured magnitude of the achievement gap means that the learning of students in private migrant schools are more than one full year behind the level of learning of students in public rural schools.

So what is driving the achievement gap? Why is it that rural public students are doing so much better than migrant students? According to our results, it can be seen that both selection and school effects are important factors for explaining the migrant-rural student achievement gap. Interestingly, however, one of the factors acts to narrow the gap (that is, the gap would have been even wider) and the others appear to widen it. Specifically, when we control for *both* the selection factors and the school effects/teaching quality indicators using the specification from Equation 2, the estimated rural-migrant student achievement gap actually stays exactly the same using dataset 1 (Table 5, Panel A, column 1 versus column 5). The measured achievement gap is −1.11 when using Equation (1) and is also −1.11 when using Equation (2). The measured gap widens modestly when using datasets 2 and 3 (Panels B and C, column 1 versus column 5). Interestingly, this is saying that if we held all things

Table 5. Possible sources of the rural-migrant student achievement gap

	Standardised math score				
Panel A: Dataset 1	1)	2)	3)	4)	5)
(1) Migrant students	−1.11***	−1.11***	−1.34***	−0.91***	−0.96***
	(0.03)	(0.03)	(0.05)	(0.06)	(0.08)
Control variables					
Indicators of self-selection					
(2) student and family characteristics		Y			Y
Indicators of school quality					
(3) School resources			Y		Y
(4) Teacher characteristics				Y	Y
No. of observation	5271	5271	5271	5271	5271
R^2	0.25	0.26	0.27	0.26	0.28
F tests					
Student and family characteristics: F-stat = 12.06; P-value < 0.00					
School resources: F-stat = 19.38; P-value < 0.00					
Teacher characteristics: F-stat = 10.11; P-value < 0.00					
Panel B: Dataset 2	1)	2)	3)	4)	5)
(1) Migrant students	−1.12***	−1.12***	−1.40***	−0.89***	−1.07***
	(0.03)	(0.09)	(0.06)	(0.07)	(0.09)
Control variables					
Indicators of self-selection					
(2) student and family characteristics		Y			Y
Indicators of school quality					
(3) School resources			Y		Y
(4) Teacher characteristics				Y	Y
No. of observation	3067	3067	3067	3067	3067
R^2	0.26	0.27	0.29	0.28	0.30
F tests					
Student and family characteristics: F-stat = 8.22; P-value < 0.00					
School resources: F-stat = 17.52; P-value < 0.00					
Teacher characteristics: F-stat = 8.03; P-value < 0.00					
Panel C: Dataset 3	1)	2)	3)	4)	5)
(1) Migrant students	−1.15***	−1.13***	−1.46***	−0.86***	−1.20***
	(0.04)	(0.10)	(0.06)	(0.09)	(0.10)
Control variables					
Indicators of self-selection					
(2) student and family characteristics		Y			Y
Indicators of school quality					
(3) School resources			Y		Y
(4) Teacher characteristics				Y	Y
No. of observation	2430	2430	2430	2430	2430
R^2	0.25	0.26	0.27	0.26	0.29
F tests					
Student and family characteristics: F-stat = 7.46; P-value < 0.00					
School resources: F-stat = 16.45; P-value < 0.00					
Teacher characteristics: F-stat = 7.39; P-value < 0.00					

Notes: Robust standard errors in parentheses; ***,** and * significant at 1 per cent, 5 per cent and 10 per cent, respectively. Column 1 is estimating Equation (1); column 5 is estimating Equation (2); columns 2–4 are estimating Equation (3). See text for exact definitions of Equations (1) –(3).

constant, the actual quality of learning in private migrant schools is even worse than the quality of learning in public rural schools (compared to the raw/observed achievement gap).

However, as we proceed with the analysis, we see that, in fact, there are different elements (self-selection, school effects and teacher quality) that are moving the achievement gaps in different directions. When we ran the model in Equation (2), except for controlling for the effects of self-selection, school and teacher quality separately across three datasets, we find that all of the effects of self-selection, school and teacher quality are by themselves significant at least at the 0.01 level according to the F-test of joint significance (Table 5, bottom part of Panel A, B and C). Accounting for the selection effect using datasets 1 and 2 (Panels A and B, column 1 versus column 2) have no measureable effect on the measured achievement effect, while it marginally narrows it using dataset 3 (Panel C, column 2 – widening from −1.15 to −1.13). In other words, at most there is a small selection effect that accounts for the smallest of share of the observed achievement gap. Most likely, because the observed differences (from Table 2) between students (families) in private migrant schools and public rural schools are not that different (in magnitude), this accounts for (at most) only a small part of the observed achievement gap.

In contrast, both the school effects and teaching quality characteristics account for a larger share of the achievement gap, though they (as expected, as discussed above) are working in opposite directions. When using all three datasets, after accounting for the nature of the facilities in private migrant schools (better) and public rural schools (worse), the measured achievement gap is wider (Table 5, Panels A-C; column 1 versus column 3). The gaps widen between 0.21 standard deviations (using dataset 1) and 0.31 standard deviations (using dataset 3) when accounting for the nature of school facilities. In other words, if the older public rural schools had facilities as good as the newer private migrant schools, the learning gap would be even wider (meaning something about the quality of education in private migrant schools – aside from school facilities – is even worse).

In contrast, after accounting for the quality of teachers in private migrant schools and rural public schools, the measured achievement gap narrows (Table 5, Panels A-C, column 1 versus column 4). In this case, we show that if teachers of equal (observed) quality were teaching in both private migrant schools and public rural schools, the learning gap would narrow by 0.20 (using datasets 1 and 2) to 0.29 standard deviations (using dataset 3). In other words, part of the reason that students in private migrant schools are learning less is due to the fact that the quality of their teachers is poorer.

Interestingly, when looked at in this way (comparing the measured gap after controlling for the different effects with the observed gap), there are two general conclusions.[3] First, because the self-selection effect is small and the school facility effect more or less offsets the teacher quality effect, the observed achievement gap (measured using Equation 1, and reported in Table 5, column 1). is not much different than the conditional achievement gap (measured using Equation 2, and reported in column 5). Second, even when accounting for the observed self-selection, school facilities and teaching quality effects, there is a large share of the observed achievement gap that is unexplained. Clearly, according to our analysis, there is something else that is causing the large difference in the quality of learning between private migrant schools and public rural schools.

Indeed, as can be seen by our approach to report results using the entire sample (more like a convenience sample) and then increasingly narrower, better match samples (the one that is supposed to have fewer unobservables), that it does matter. In all of our cases (for all of the different empirical exercises in which we use all three of our samples), there are differences in the results. This means, in some sense, that there are unobservables that are not being accounted for and that the difference between our convenience sample and the narrow sample (assuming there are fewer differences in the unobservables when using the narrower sample) is measurement bias. However, it should also be noted that, at least in the case of our study, the nature of the bias is not all that severe. Now, this may or may not be true in other samples, but, if our sample was typical of other migrant communities and their matched rural communities, then, using the convenience sample would not result in too severe of a bias.

3.4. Are learning outcome different among migrant communities?

In this subsection, we seek to understand if the impact of the programme differs by the source community of the migrant students. In the context of our study, this means that we want to know if learning outcomes differ between Shanghai and Suzhou. Given our surprising results (rural students in rural public schools are much better than migrant students in private migrant schools), this line of questioning seems indeed to be an interesting one.

To do this, we undertake one additional exercise through two tables. The first table will examine differences between private migrant schools (and students and families) in Suzhou and Shanghai. The second will present the results of a heterogeneous analysis that is carried out by defining a variable that equals one if the student attended a private school in Shanghai and zero if not. This variable is then included in the regression (of our basic model) and we can see if, holding all other things constant (including being a migrant student in general), does going to a private school in Shanghai produce higher or lower learning outcomes (compared to other migrant students attending private migrant schools). When doing so, the coefficient on the migrant student variable is then the effect of being a Suzhou student (compared to being a rural student in rural public schools).

The results of this two-step analysis are shown in Appendix Table A2 and Table 6. Appendix Table A2, which compares migrant students in Suzhou and Shanghai, shows that the nature/quality of the students (and their families) going to school in Suzhou are superior to those going to school in Shanghai. Specifically, there are more single children in Suzhou; family sizes are smaller in Suzhou; and the level of education of mothers is higher in Suzhou. In contrast, school facilities are better in Shanghai. Hence, ex ante it is difficult to predict if school outcomes will be better in Suzhou or Shanghai since there are potentially offsetting effects.

The results of heterogeneous analysis (regression analysis) are presented in Table 6. Our results show that school learning in both Suzhou (the coefficient on the migrant variable is negative and significant) and Shanghai (the coefficient on the Shanghai variable is also negative and significant) is still lower in migrant communities (when migrant students attend private migrant schools relative to rural students attending rural public schools). However, the results show also that the learning outcomes of students in Shanghai are lower than those in Suzhou. While we do not know precisely why, given the results in Appendix Table A2, it would appear that the learning effect associated with having higher quality students/families in Suzhou is more than offsetting the effect of having better facilities in Shanghai.

4. Conclusion

In order to understand the education system of urban migrant students, we empirically compared the academic performance of students in private migrant schools to that of students in rural public schools. While we use methodological approaches that are quite similar to those in Lai et al. (2014) and Chen et al. (2009), our biggest contribution is the uniqueness of our dataset. Unlike other studies, we compare the standardised test scores of students attending rural public schools in our three core study areas with those of migrant students in our sample private migrant schools who are from households that originally came from the same source communities. Using both descriptive and multivariate analysis, we find a robustly significant achievement gap between migrant students and rural public school students. In short, rural public school students outperform the private migrant schools by 1.12 SDs on the standardised math test.

Our paper not only identifies the achievement gap, but also seeks to identify sources of that gap. Based on the analysis used in this paper, we found that selection effects only account for a small part of the observed achievement gap because the observed difference between students (families) in private migrant schools and rural public schools are not that different. Furthermore, we find that school facilities and teaching quality play important roles in the rural-migrant student achievement gap – although these effects occur in opposite directions. After accounting for the quality of teachers between the two types of schools, the conditional achievement gap is narrower. Although teachers in

Table 6. Heterogeneity tests of possible sources of the rural-migrant student achievement gap between migrant students in Shanghai and Suzhou

	Standardised math score				
Panel A: Dataset 1	1)	2)	3)	4)	5)
(1) Migrant students	−0.91***	−0.91***	−1.18***	−0.52***	−0.73***
	(0.03)	(0.03)	(0.06)	(0.07)	(0.09)
Dummy of migrating in Shanghai (1 = yes, 0 otherwise)	−0.29***	−0.28***	−0.30***	−0.38***	−0.36***
	(0.03)	(0.03)	(0.05)	(0.04)	(0.04)
Control variables					
Indicators of self-selection					
(2) student and family characteristics		Y			Y
Indicators of school quality					
(3) School resources			Y		Y
(4) Teacher characteristics				Y	Y
No. of observation	5271	5271	5271	5271	5271
R^2	0.26	0.26	0.27	0.28	0.29
F tests					
Student and family characteristics: F-stat = 10.95; P-value < 0.00					
School resources: F-stat = 15.27; P-value < 0.00					
Teacher characteristics: F-stat = 10.50; P-value < 0.00					
Panel B: Dataset 2	1)	2)	3)	4)	5)
(1) Migrant students	−0.88***	−0.88***	−1.19***	−0.44***	−0.77***
	(0.07)	(0.05)	(0.06)	(0.10)	(0.12)
Dummy of migrating in Shanghai (1 = yes, 0 otherwise)	−0.31***	−0.31***	−0.34***	−0.47***	−0.46***
	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)
Control variables					
Indicators of self-selection					
(2) student and family characteristics		Y			Y
Indicators of school quality					
(3) School resources			Y		Y
(4) Teacher characteristics				Y	Y
No. of observation	3067	3067	3067	3067	3067
R^2	0.27	0.28	0.29	0.29	0.30
F tests					
Student and family characteristics: F-stat = 8.17; P-value < 0.00					
School resources: F-stat = 17.02; P-value < 0.00					
Teacher characteristics: F-stat = 10.77; P-value < 0.00					
Panel C: Dataset 3	1)	2)	3)	4)	5)
(1) Migrant students	−0.98***	−0.97***	−1.29***	−0.49***	−0.92***
	(0.07)	(0.07)	(0.09)	(0.12)	(0.14)
Dummy of migrating in Shanghai (1 = yes, 0 otherwise)	−0.21***	−0.20***	−0.23***	−0.40***	−0.40***
	(0.08)	(0.07)	(0.08)	(0.09)	(0.10)
Control variables					
Indicators of self-selection					
(2) student and family characteristics		Y			Y
Indicators of school quality					
(3) School resources			Y		Y
(4) Teacher characteristics				Y	Y
No. of observation	2430	2430	2430	2430	2430
R^2	0.25	0.26	0.28	0.27	0.29
F tests					
Student and family characteristics: F-stat = 7.37; P-value < 0.00					
School resources: F-stat = 16.60; P-value < 0.00					
Teacher characteristics: F-stat = 8.97; P-value < 0.00					

Notes: Robust standard errors in parentheses; ***,** and * significant at 1 per cent, 5 per cent and 10 per cent, respectively. Column 1 is estimating Equation (1); column 5 is estimating Equation (2); columns 2–4 are estimating Equation (3). See text for exact definitions of Equations (1)–(3).

rural public schools are more qualified, migrant schools have better facilities. When we control for these facilities (in a slight way), the measured achievement gap widens.

Therefore, one interpretation of our findings is that despite the lower quality of school facilities, rural public school students still outperform migrant students by a large margin. Our results also indicate that a small part of this performance gap is due to the fact that the quality of teachers in rural public schools is better than that of teachers in private migrant schools. Overall, the quality of education appears to be so poor in private migrant schools that it harms the educational performance of students. Although we do not know the precise reason for this situation, there are several possibilities, such as the absence of effort of teachers and administrators; the constant turnover of staff and students; and the stresses of living in a migrant community. It is likely some combination of these factors that is producing this wide achievement gap.

Our results have important implications for the education of China's migrant children. Academic progress is necessary to prepare these children for the demands of the future labour market which, in turn, is central to China's future social stability and sustainable economic development. However, according to our data, migrant schools have been unsuccessful in delivering quality education to migrant children. For this reason, it is necessary to implement new measures to improve the academic outcomes of this group of students.

One method that could be employed to improve the educational performance of migrant students is expanded access to urban public school systems in order to provide a public education to all children living in China's cities, regardless of hukou status. Although this is an expensive proposition, providing migrant students with a high quality education should be made a priority. Expanding access to higher-quality education in this manner offers an opportunity to raise the human capital of millions of students, who one day will become key players in China's labour market. However, even if China makes a policy decision to provide urban public education for all migrant students, change will not likely happen overnight. Therefore, it is also necessary for policy-makers to improve infrastructure and teaching resources in migrant schools in the short-run. We suggest that increased investment should be made into migrant schools to improve teacher quality and the institutions' overall commitment to providing quality education.

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Notes

1. There are two reasons why we did not match students from migrant schools with their own home counties and instead chose sample counties by randomly choosing counties in each of the Core Prefectures. First, while all students (or almost all students) know what prefecture they were from, not all knew the name of their home counties. Second, when looking at the students that did know their home counties, in fact, the distribution across counties is fairly uniform.
2. Details of the Trends in International Mathematics and Science Study can be found at http://timss.bc.edu/home/pdf/TP_About.pdf.
3. We also ran the results using a Propensity Score Matching (PSM) approach (matching the student and family characteristics variables – the regression model used to produce the results in Table 5), and the results from the PSM approach were substantially unchanged (from the results reported in Table 5).

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Appendix

Table A1. Descriptive statistics of student and family characteristics using dataset 1 and dataset 2

	Rural students	Migrant students	Difference b/w migrant and rural students
Student and family characteristics			
Gender (1 = male; 0 = female)	0.51	0.55	0.03**
If single child in the family (1 = yes; 0 = no)	0.11	0.15	0.00***
Family size (persons)	4.33	4.69	0.00***
Education attainment of father (1 = high school and above; 0 otherwise)	0.60	0.59	0.67
Education attainment of mother (1 = high school and above; 0 otherwise)	0.44	0.41	0.08*
Observations in dataset 1	1516	3755	
Student and family characteristics			
Gender (1 = male; 0 = female)	0.51	0.53	0.27
If single child in the family (1 = yes; 0 = no)	0.11	015	0.00***
Family size (persons)	4.33	4.68	0.00***
Education attainment of father (1 = high school and above; 0 otherwise)	0.60	0.60	0.84
Education attainment of mother (1 = high school and above; 0 otherwise)	0.44	0.40	0.02**
Observations in dataset 2	1516	1551	

Source: Authors' own survey.
Notes: ***,** and * significant at 1 per cent, 5 per cent and 10 per cent, respectively.

Table A2. Descriptive statistics of student and family characteristics, school effects and teacher quality between migrant children in Shanghai and Suzhou

	Shanghai	Suzhou	Difference b/w migrant and rural students
Student and family characteristics			
Gender (1 = male; 0 = female)	0.54	0.56	0.27
If single child in the family (1 = yes; 0 = no)	0.12	0.22	0.00***
Family size (persons)	4.72	4.62	0.05**
Education attainment of father (1 = high school and above; 0 otherwise)	0.59	0.60	0.71
Education attainment of mother (1 = high school and above; 0 otherwise)	0.39	0.45	0.00***
Observations	2683	1072	
School effects			
Age of the school (year)	11.29	10.36	0.44
The school has reading room (1 = yes; 0 = no)	0.86	0.64	0.02**
The school has computer class (1 = yes; 0 = no)	1.00	0.91	0.01***
The school has computer tutoring (1 = yes; 0 = no)	0.97	0.81	0.01***
Number of teachers (no.)	31.06	47.32	0.00***
Class size (number of student in a class)	42.75	53.59	0.00***
Observations	65	22	
The characteristics of school teacher			
Female teacher share (%)	0.67	0.72	0.09*
Share of rank III (%)	0.01	0.03	0.19
Share of rank II (%)	0.11	0.09	0.39
Share of rank I (%)	0.12	0.17	0.20
Share of formal teacher credentials (%)	0.46	0.03	0.00***

(*continued*)

Table A2. (*Continued*)

	Shanghai	Suzhou	Difference b/w migrant and rural students
Education attainment of teacher head (1 = with college degree and above; 0 otherwise)	0.98	1.00	0.56
Teaching experience of teacher head (year)	11.51	10.52	0.69
Observations	65	22	

Source: Authors' own survey.
Notes: ***,** and * significant at 1 per cent, 5 per cent and 10 per cent, respectively.