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The education of China's migrant children: The missing link in China's education system

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ABSTRACT

This paper examines the academic performance of migrant students in China and explores determinants of their performance. The paper compares academic performance, student backgrounds and measures of school quality between private schools attended only by migrant children in Beijing (Beijing migrant schools) and rural public schools in Shaanxi province. Furthermore, we employ multivariate regression to examine how individual characteristics and school quality affect migrant student performance and the achievement gap between migrant students and those in rural public schools. We find that although migrant students outperform students in Shaanxi's rural public schools when they initially arrive in Beijing, they gradually lose ground to rural students due to the poorer school resources and teacher quality in their schools. Additional analysis comparing migrant students in migrant schools to migrant students in Beijing public schools demonstrates that given access to better educational resources, migrant students may be able to significantly improve their performance.

1. Introduction

The "iron law" of economic development states that as a nation industrializes, the proportion of its population engaged in farm labor decreases and the proportion engaged in off-farm labor increases (Kuznets, 1955). This shift reflects the phenomenon whereby people who once farmed the land move to cities in search of opportunity and provide labor to the expanding industrial sector.

In China the movement of people from rural to urban areas has increased dramatically over the past 30 years due to the country's rapid economic development. From 1978 to 2004 China's gross domestic product grew more than 10-fold (CNBS, 1990–2008). Over the same period millions of migrants moved from rural areas to cities in search of work. Thus, while in 1990 migrant laborers accounted for only 8% of China's total number of rural laborers, by 2008 225 million migrants—approximately 20% of the total rural labor force in China—were living and working in China's urban areas.

While labor has flowed relatively freely from agriculture to industry, the process of shifting lives, homes and families has been more difficult. A core aspect of the challenges migrants face is found in China's *hukou* household registration system (Naughton, 2007), which classifies China's citizens as either rural or urban residents. Without an urban *hukou* migrants and their families have limited access to urban public services, including housing, healthcare, social security, and above all, education. As a result, life in the cities can be immensely challenging for millions of migrant families.

Despite the challenges, an increasing number of migrants have begun bringing their children to the cities (Sa, 2004). These children are China's so-called *migrant children*. Those who remain in rural areas while their parents migrate to the cities for work are called *left-behind children*. The number of migrant children has been increasing at a high rate (ACWF, 2008). In 2008 an estimated 20 million migrant children were living with their parents in China's cities.

As the number of migrant children has risen, the education of migrant children has become one of the greatest challenges faced by both migrant families and the Chinese education system, a challenge that has not always been successfully met. In China today public schools in both rural and urban areas are supposed to provide free education to children. However, this free education is only guaranteed for children whose hukou matches the school's

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location (Sa, 2004). Given that migrant children in cities still retain their rural hukous, they are allowed to enroll in urban public schools only if there is available space. In many cases migrant parents can only enroll their children in urban public schools if they are willing and able to pay steep out-of-district tuition fees. Consequently, in major metropolitan areas, such as Beijing, tens of thousands of children are still unable to attend public schools, falling into a conspicuous gap in the provision of public education (Han, 2004; Kwong, 2004).

Because the public education system fails to cover migrant children, privately run, tuition-funded, for-profit *migrant schools* began to spring up in the 1990s, quickly becoming the major venue for the education of migrant children (Ma et al., 2008). With tuition fees set at levels more reasonable than those charged by public schools for out-of-district students, migrant schools admit migrant children regardless of their hukou status. Many parents, unable to enroll their children in urban public schools, thus turn to migrant schools. While data do not exist showing exactly what fraction of migrant children is enrolled in migrant schools, estimates are high. For example, in Beijing it is estimated that 70% of migrant children attend migrant schools. Case studies on the schooling of migrant children in major cities, such as Beijing and Shanghai, suggest that hundreds of thousands of migrant children attend migrant schools in China's cities (e.g., Stepping stones, 2010).

Long-standing public concern about migrant children and the sheer volume of students enrolled in migrant schools throughout China give rise to a fundamental question: How do migrant children perform academically, particularly compared to children in China's formal (both rural and urban) public school system? Despite the fundamental importance of this issue, to our knowledge there have been almost no studies that empirically examine the academic performance of migrant children and compare it with that of children in China's public schools. The only exception is an unpublished paper by Song et al. (2010) which finds that attending Beijing public schools is beneficial to the academic performance of migrant students. Most other studies on the education of China's migrant children are anecdotal or descriptive (CCAP, 2009; Ding, 2004; Han, 2004; Human Rights Watch, 2006; Kwong, 2004; Liu, 2002; Ma et al., 2008). In these studies, privately run migrant schools, the main venue of education for migrant children, are often described as unregulated, with poor facilities, under-qualified teachers and fragmented curricula. Such schools are often transient, with sudden closings due to anything from having their leases pulled because of rebuilding projects to local regulation violations. The poor quality of migrant schools and their staff raises serious questions about the quality of education that they can deliver. There is a clear need for a careful examination of the academic performance of migrant students, the majority of whom attend migrant schools.

The overall goal of this paper is to present evidence on the academic performance of migrant students and explore the determinants of migrant student performance. One of the most important reasons for the lack of empirical evidence on migrant student performance is the lack of quantitative data on migrant schools. In our study we collected data on 23 Beijing migrant schools and the students in these schools. We also use data from a sample of 70 rural public schools in nine poor counties in rural areas of Shaanxi province as well as from a sample of 11 classes in four public schools in Beijing. Comparisons between migrant schools and rural/urban public schools in our sample help us gauge the academic performance of migrant students.

To meet the goal of this paper, we undertake two sets of comparative analyses. First, we compare student academic performance between Beijing migrant schools and poor rural public schools in Shaanxi. We also compare student backgrounds and school quality (measured by school resources and teacher qualifications) between these two types of schools in order to explore possible determinants of student performance and of the observed achievement gap between migrant students and poor rural students. Second, we employ multivariate regression to rigorously examine how individual backgrounds, school resources and teacher qualifications affect migrant student performance and the achievement gap. In addition, we also conduct the same sets of comparative analyses to compare student academic performance between migrant students in Beijing migrant schools and Beijing public schools.

While ambitious in scope, there are limitations to our study. Although we identify gaps in the performance of migrant students and students in rural public schools, our observational data do not allow us to definitively prove that the differences are causal in nature. Moreover, although we seek to control for self-selection, there still may be a number of unobservable factors that cannot be fully accounted for. In the subsequent analysis, we will explore the nature of these selection issues and seek to control for as many of the observed characteristics as possible. We hope that we have left only limited space for unobserved factors to confound our inferences.

The remainder of this paper is arranged as follows: The first section describes the data sets we collected for the analysis and explains the empirical strategy that we use to approach the main research questions. The next two substantive sections report on the results of the empirical analysis and other supporting evidence. The last section summarizes the findings and concludes.

2. Research methodology

2.1. Data

In our analysis we draw on three data sets. The first data set comes from Beijing migrant schools. The second data set comes from rural schools from poor areas of Shaanxi Province in northwestern China, China's remote rural region. The third data set comes from Beijing public schools that are located close to the migrant schools in our sample. The three data sets are designed so that the data—especially through the use of a single, standardized test—can be used to compare the educational performance of students in Beijing migrant schools to that of students in rural schools in poor rural areas and local public schools in Beijing.

2.1.1. Beijing migrant school data

Using a list of all 230 migrant schools in Beijing collected by our research team,[1] we chose our sample of migrant schools. We first divided the list by district and excluded all districts with fewer than five schools. This focused our study on districts where migrant schools are more concentrated. There are a total of seven districts in our sample. We randomly chose ten percent of the schools in each of these districts to represent the migrant schools in each district. Our total sample includes 23 schools. Because of the availability of international standard testing resources that allow us to create exams that are comparable across China, we

[1] The first step in collecting a representative data set on migrant schools in Beijing was to collect a comprehensive list of schools. Unlike public schools, no official list of Beijing migrant schools is available. To collect a comprehensive list of migrant schools in Beijing we contacted all educational and research institutes and non-profit organizations in the greater Beijing area that might have contact information for Beijing migrant schools. We then called each school to confirm that the school was still open. During each phone call we also asked the principal of each school if there were any other schools in their area. By proceeding in this way we believe that we were able to establish as complete a list of Beijing migrant schools as possible—certainly more complete than any other existing list. A total of 230 schools were on our list.

decided to examine fourth grade students in our sample schools.[2] All of the fourth grade students in the 23 sample schools are included in the study. A total of 931 fourth-grade students were sampled, approximately 40 students per school.

Our sample thus set, our enumeration team visited each school and undertook a two-part baseline survey effort in December 2008. The first part of the survey focused on the fourth grade students in the school. It consisted of two blocks. In the first block students were given a standardized math test. The test questions were selected from the TIMSS test for fourth grade students.[3] The test included 29 questions and the students were required to finish in 30 min. We chose our test questions from the repository of TIMSS test questions because, as one of the most widely implemented assessments of cross-county educational performance, the scores from TIMSS tests provide reliable and informative information on math achievement for 4th-grade students. Such a test also facilitates comparison of student performance across different regions and among countries. Our enumeration team monitored the test and strictly enforced the time limits. We use the scores of the students on this test as our measure of student academic performance.

In the second block, enumerators collected data on the characteristics of students and their families. From this part of the survey we are able to create demographic and socioeconomic variables that include each student's *age* (measured in years), whether they were an *only child*, how many elder siblings they had (or *number of elder siblings*), how many younger siblings they had (or *number of younger siblings*), *father's education level*, *mother's education level* and the *number of meals* that each child typically ate per day (either two or three). There was also one question asking about each student's *length of stay* in Beijing as a migrant. The survey also includes information about the students' academic background, including whether they had *attended any kindergarten* and whether they had *ever repeated a grade*. These variables, or similar ones, have been used in many studies to explain inter-student differences in academic performance (e.g. Behrman and Rosenzweig, 2002; Coleman et al., 1966; Currie and Thomas, 1995; Fryer and Levitt, 2004).

The second part of the survey collected information about school resources and the nature and quality of the teaching staff from the school principals. School resource measures include the *school size* (number of students in the school), *student–teacher ratio*, *student–school area* ratio (measured as the number of students per square meter), *student-classroom ratio* (the number of students divided by the number of classrooms in the school), the share of the teaching staff that was female (or *female teacher share*), the *age of the school* (measured in years since the school began to operate), the *age of the main buildings at the school* and the availability of certain facilities (*computer lab, library, hot water and clinic*). To measure the average teacher quality the principal form asked about the share of teachers belonging to each of the four official teaching quality ranks. The teaching quality ranking system in China is a long-established official evaluation of teachers' comprehensive quality. There are four tiers in the ranking, with Tier I representing the worst/least experienced teachers and Tier IV representing the best. The wages of teachers and their welfare package to a great extent depend on their rank. In China's education system, the evaluation and assignment of the teaching rank is almost always carefully executed (and monitored by officials above and by committees within the jurisdiction) by education bureaus through a rigorous protocol.[4] In our analyses we use the *share of Rank II teachers* and *share of Rank III teachers* in the schools as measures of teacher quality.

As students in our sample are all in fourth grade, the principal form also specifically collected data on the characteristics and

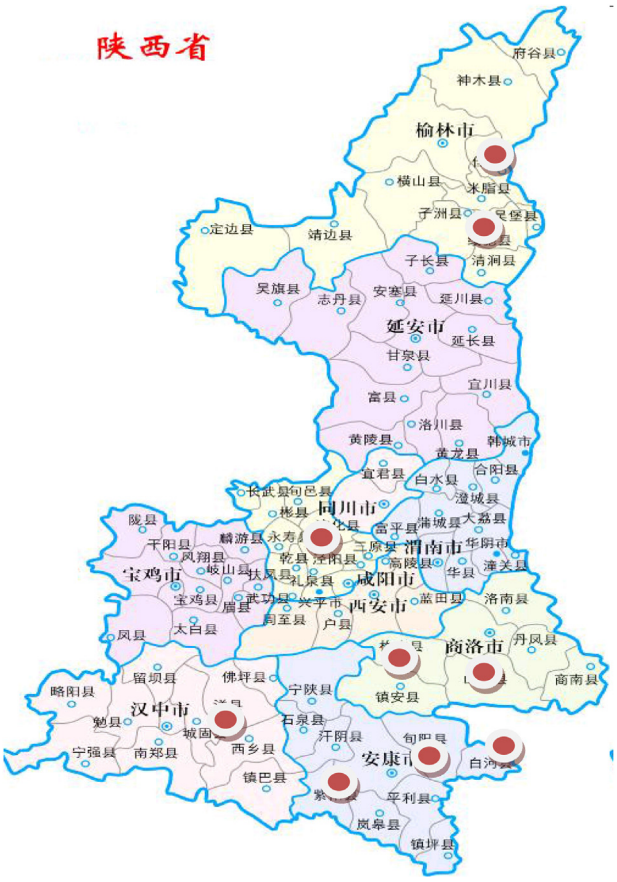

Fig. 1. Locations of the sample counties in Shaanxi Province (in red dots). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)
Source: China map.

[2] In order to create reliable measures of student educational performance, we chose our test questions from the Trends in International Mathematics and Science Study (TIMSS) math tests, which is an international assessment of the mathematics and science knowledge of fourth- and eighth-grade students around the world. At the primary school stage, the TIMSS tests are only designed for fourth-grade students, so our study focuses on fourth-grade students.

[3] The Trends in International Mathematics and Science Study (TIMSS) is an international assessment of the mathematics and science knowledge of fourth-grade (and eighth-grade) students around the world. TIMSS was developed by the International Association for the Evaluation of Educational Achievement (IEA) to allow participating nations to compare students' educational achievement across borders. TIMSS was first administered in 1995, and every 4 years thereafter. As of 2007, 48 countries had participated in the study. We chose questions for our test from "TIMSS 2003 4th-Grade Mathematics Questions," a repository of test questions that were made available to us. There were 70 test questions from five content domains in total. These content domains included Numbers (32 items), Measurements (14 items), Geometry (nine items), Data (eight items) and Patterns and Relationships (seven items). Our research team chose 29 questions from the 70 test question data base. The balance of questions across the content domains was done to match the curriculum of the students in our sample. Among the 29 questions in the test, 19 of them were from the Numbers content domain; five from the Measurement content domain; four the Patterns and Relationships content domain; and one from the Geometry content domain.

[4] The teaching quality rank is usually determined by factors such as teacher's education, experience, performance, and principal evaluation. The education bureau also sends officials to audit the teacher's lectures when making rank decisions. Many migrant school teachers are not formal teachers, and thus do not have any quality rank. To earn a ranking, they have to be able to demonstrate to the schools and to the education bureaus that they are qualified for a formal teaching position. Teachers who do not have any teaching quality rank are usually temporary teachers without any formal training and do not adhere to the regulations of the ranking system. In general they have lower overall teaching competency than ranked teachers.

Table 1
Number of schools in each county (the sample of rural schools in Shaanxi).

County	# of schools
Baihe	8
Chunhua	4
Jia	6
Shanyang	8
Suide	6
Xunyang	20
Yang	9
Ziyang	4
Zhashui	5
Total	70

qualifications of the school's fourth-grade teachers. Three blocks of the form were devoted to questions about the characteristics of the fourth grade math teachers, Chinese teachers and homeroom teachers (banzhuren). Teacher characteristics include: teacher's gender, teacher's education level, teacher's official quality rank (as discussed above) and years of teaching experience. With data from this form we create variables demonstrating the average qualifications of teachers who taught the sample students, including *share of teachers with university degree, share of teachers with professional college degree*, *years of teaching experience* and the *share of Rank III and above teachers*. All these variables are measures of teacher qualifications widely used in educational studies (e.g. Koedel and Betts, 2007; Lai et al., 2011; Rivkin et al., 2005; Rockoff, 2004).

2.1.2. Rural public school data in Shaanxi province

The data on China's rural public schools come from schools in Shaanxi province. In Shaanxi, around 63% of the population lives in rural areas (CNBS, 2005). The incidence of rural poverty in Shaanxi in 2005 was 2.9 times higher than the national average (OECD, 2009). Shaanxi also has had one of the slowest rates of poverty reduction in rural China since 1981 (Ravallion and Chen, 2007).

To obtain our sample, we first chose our sample counties in poor rural areas in Shaanxi. We chose the nine poorest counties in the province.[5] The locations of the study counties are shown in Fig. 1. The average per capita income of the nine sample counties was 1600 RMB per year in 2005 which is far below China's average rural income per capital of 3250 RMB (CNBS, 2005).

The survey team next chose sample schools in each county. To do this, we first obtained a list of all schools in each county. We then narrowed this list to include only elementary schools with six full grades (i.e., grades one to six). A total of 115 schools met these criteria. From this list, we randomly selected 70 schools for inclusion in our sample. Table 1 shows a summary of the counties in the study and the number of schools in each county.

In Shaanxi, we also focused on fourth grade students. By doing so, we are able to compare students in the Shaanxi sample to students in the Beijing migrant school sample. All fourth grade students in the 70 rural schools were included in our sample. In total there were 4158 students in our sample of poor rural schools in Shaanxi, just under 60 fourth graders per school.

As with Beijing migrant schools, we conducted a two-part survey among the rural school students and principals in our sample in November 2008. The first part involved giving the students a 30-min math test and a survey of individual and family characteristics. The same math test was used in both the rural schools and the migrant schools. The student survey was also nearly identical to the one used in Beijing migrant schools. The second part of the survey also focused on principals. The principal form, which was nearly identical to the one used in the migrant schools, also allowed us to collect information about school resources and teacher characteristics.

2.1.3. Beijing public school data

In order to collect data on public schools in Beijing, we first obtained a complete list of all public schools in the same neighborhoods as the migrant schools in our sample. We restricted public schools to those within the same neighborhood as the migrant schools we were studying to eliminate systematic neighborhood differences and thus achieve a better match for comparison. We then called each school on the list, requesting permission to survey their students. Four public schools granted us access. In June, 2009, the same math test was administered in the Beijing public schools as in the Beijing migrant schools and the Shaanxi public schools. The student survey form was also nearly identical. We collected information on all fourth-grade students in 11 classes at four Beijing public schools, a total of 427 students. Of the students surveyed, 63% of them were children of migrant parents.[6]

2.2. Empirical strategy

We use a two-step approach to examine educational performance in migrant schools relative to rural/urban public schools. In the first step we conduct a simple comparison of test scores. We also descriptively explore the correlates of the differences in academic performance between migrant students and rural/urban students in public schools in the rural areas (Shaanxi)/urban areas (Beijing).

In the second step we use multivariate regression analysis to examine the rural/urban-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/urban-migrant student achievement gap without controlling for any student and school characteristics that might affect student performance. The model is as follows:

$$y_{is} = \alpha + \beta \cdot mig_i + \varepsilon_{is} \quad (1)$$

where y_{is} is the standardized math test score of student i in school s, and mig_i is a dummy variable equal to one for Beijing migrant school students and zero for rural/urban students. By construction, the coefficient of the dummy variable mig_i, β, is equal to the unconditional difference in mean test scores between migrant school students and rural public school students in the Shaanxi sample.

After estimating the size of the achievement gap, we then seek to analyze the determinants of the gap. There are two possible reasons for the achievement gap that we are interested in identifying. First, there may be what we call a *selection effect*. Parents may select children who have better (or worse) academic potential to take to Beijing. It also may be that parents who are better able to provide a favorable study environment in Beijing are more likely to bring their children along with them. Therefore, students in migrant and rural schools could have systematically different academic and family backgrounds, resulting in the

[5] To do this, we first obtained a list of all counties in each of the two poor regions of Shaanxi: North and South. Using a high quality poverty map of Shaanxi (Olivia et al., 2009), we then gave each of the counties on the list a poverty ranking. Then we chose nine poorest counties in the province according to the poverty ranking.

[6] Admittedly, these four public schools cannot be considered randomly selected. Results based on this sample are, therefore, not fully generalizable. Nonetheless, given the scarcity of rigorous quantitative studies on the relationship between school type and the academic performance of migrant students, incorporating this small sample of public schools into our study will still yield useful information. In addition, principals in some of the Beijing public schools were unwilling to fill in the principal form that would have provided information on school resources and teacher characteristics. As a result, the subsequent multivariate analysis lacks this information.

observed rural/urban-migrant student achievement gap. A second possible reason for the achievement gap between rural/urban and migrant students may be differences in the quality of the schools. Beijing migrant schools and rural/urban schools might differ in terms of school resources and facilities and teacher quality. We term this the *school effect*.

To empirically assess whether the selection effect or the school effect (or both) can explain the observed achievement gap between rural/urban and migrant school students, we build on our basic model in Eq. (1) by adding additional control variables that we hope will be able to capture at least the part of the selection effect and school effect due to observable factors. The regression model to perform this analysis is:

$$y_{isc} = \alpha + \beta' \cdot mig_i + X_i\gamma + S_s\eta + T_{sc}\theta + \varepsilon_{isc} \quad (2)$$

where c is a class index, X_i is a vector of student and family characteristics of student i, S_s is a vector of school resource measures, and T_{sc} is a vector of the average characteristics of all teachers teaching class c in school s.

The student and family characteristics vector (X_i) is comprised of a rich 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 student characteristics (*age*, *only child*, *number of elder siblings*, *number of younger siblings*, *father's education*, *mother's education* and *number of meals*) and student academic background (*attended any kindergarten* and *ever repeated a grade*).

The indicators of school quality include school resources, S_s (school size, student–teacher ratio, student–school area ratio, student–classroom ratio, age of the school, age of main buildings at the school and the availability of certain facilities) and teacher characteristics, T_{sc} (female teacher share, share of Rank II teachers, share of Rank III teachers, years of teaching experience, share of teachers with university degree, share of teachers with professional college degree and share of Rank III and above teachers).

In Eq. (2) β' represents the rural/urban-migrant student achievement gap conditional on rural/urban and migrant students having the same student and family characteristics (measured by X_i) and attending schools of the same quality (measured by S_s and T_{sc}). In other words, β' measures the remaining part of the rural/urban-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 school resources (S_s) and teacher characteristics (T_{sc})).

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

If after controlling for factors X_i, S_s and T_{sc} the conditional achievement gap, β', remains statistically significant, there could be several interpretations. 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/urban and urban areas. Given data constraints, further discussion of this first interpretation, though interesting, is out of the scope of this paper. A second possible interpretation might be that the selection effect (captured by factors in X_i) and the school effect (captured by factors in S_s and T_{sc}) affect the rural/urban-migrant student achievement gap in opposite directions and cancel each other out, thus keeping the estimated achievement gap unchanged after controlling for both effects.

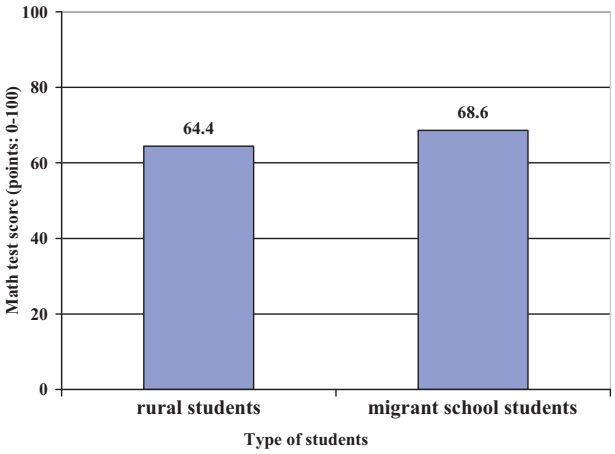

Fig. 2. Comparison of the mean standardized math test score between rural students and migrant students.
Source: Authors' survey.

In order to explore this second interpretation, as well as to examine how the selection effect and the school effect each affects the rural/urban-migrant student achievement gap, we control for the student and family characteristics (X_i) and the indicators of school quality (S_s and T_{sc}) one set at a time in the model. The consequent change in the estimated achievement gap reveals how each of the two effects (self-selection and school quality) influences the rural/urban-migrant student achievement gap. In order to gauge the statistical significance of each set of factors X_i and (S_s, T_{sc}) in determining student performance, we also conduct F-tests of joint significance of the elements in each set of parameter vectors γ and (η, θ), respectively.

3. Results

3.1. Rural–migrant student achievement gap

The data clearly show migrant students performed significantly better than students in poor rural schools in Shaanxi (Fig. 2). On a 0–100 scale the migrant school students in our sample scored an average of 68.6 points on the standardized math test score. The rural school students only scored 64.4 points. The difference in the two sets of scores, 4.2 points, is equal to a change of approximately 0.3 standard deviations. We also calculated the rural–migrant student achievement gap by restricting our sample to observations with full information on student and family characteristics, school resources and teacher characteristics (the sample we use for the subsequent multivariate analysis, i.e. the *analytic sample*), and still find a significant achievement gap of 2.7 points (0.18 standard deviations) in favor of migrant students (Table 2, row 1, column 10). In the educational literature this degree of difference is considered fairly large (Koedel and Betts, 2007; Rivkin et al., 2005; Rockoff, 2004).

3.2. Self-selection versus school quality

Using our data to examine the different sources of the rural–migrant student achievement gap, we find that migrant students have significantly stronger academic and family backgrounds than rural students, indicating that self-selection (the selection effect)

Table 2
Summary statistics of student and family background variables.

	Student and family characteristics	Whole sample					Sample with full information (the analytic sample)[a]				
		Rural students		Migrant students		Difference b/w migrant and rural students	Rural students		Migrant students		Difference and rural b/w migrant students
		# of obs	Mean	# of obs	Mean		# of obs	Mean	# of obs	Mean	
		(1)	(2)	(3)	(4)	(5)	(6)	(V)	(8)	(9)	(10)
(1)	Math test scores	4158	64	931	69	4 24**	2789	66	304	68	2.73**
(2)	Female	4158	0.44	931	0.44	−0.01	2789	0.44	304	0.45	0.02
(3)	Repeated a grade	4056	0.43	931	0.33	−0.10**	2789	0.42	304	0.31	−0.11**
(4)	# of elder siblings	3726	1.00	922	0.76	−0.24**	2789	0.95	304	0.78	−0 17**
(5)	# of younger siblings	3686	0.74	923	0.62	−0.13**	2789	0.72	304	0.61	−0.11*
(6)	Only-child	4158	0.19	931	0.22	0.04*	2789	0.22	304	0.24	0.01
(7)	# of meals/day	4084	1.58	847	1.89	0.31**	2789	1.57	304	1.93	0.36**
(8)	Father's edu (years)	4040	8.83	750	8.78	−0.04	2789	8.88	304	8.75	−0.14
(9)	Mother's edu (years)	3951	8.28	775	8.09	−0.19*	2789	8.32	304	8.05	−0.27*
(10)	No kindergarten	4158	0.44	931	0.43	−0.01	2789	0.46	304	0.40	−0.06*

[a] Sample with full information (the analytic sample) indicates the sample with full information on the student and family characteristics, school resources, and teacher characteristics (the analytic sample used in the full-model regression analysis following Eq. (2) in the text).
* Significant at 5%.
** Significant at 1%.

Table 3
Summary statistics of school and teacher characteristics.

		Whole sample					Sample with full information (the analytic sample)[a]				
		Rural school		Migrant school		Difference migrant–rural	Rural school		Migrant school		Difference migrant–rural
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		#obs	Mean	#obs	Mean		#obs	Mean	#obs	Mean	
(1)	Age of the school	68	45.75	23	8.78	−36.97***	64	46.31	11	7.91	−38.40***
(2)	Age of the main building	69	9.16	16	12.50	3.34*	64	8.55	11	11.36	2.82
(3)	Student–classroom ratio	69	35.15	22	35.69	0.54	64	36.06	11	42.16	6.09
(4)	Student–school area ratio	68	0.43	22	0.20	−0.23	64	0.45	11	0.13	−0.31
(5)	Student–teacher ratio	70	15.68	22	24.81	9.13***	64	15.69	11	21.74	6.05***
(6)	Number of students	70	401.56	22	673.82	272.26***	64	402.52	11	633.00	230.48***
(7)	The school has computer class	69	0.45	22	0.27	−0.18	63	0.44	11	0.36	−0.08
(8)	The school has reading room	69	0.41	20	0.55	0.14	63	0.41	9	0.33	−0.08
(9)	The school has hot water	70	0.20	23	0.17	−0.03	64	0.22	11	0.09	−0.13
(10)	The school has a clinic	69	0.65	22	0.64	−0.02	63	0.65	11	0.55	−0.11
(11)	Share of Rank III teachers	70	0.29	23	0.15	−0.14***	64	0.29	11	0.25	−0.05
(12)	Share of Rank II teachers	70	0.53	19	0.20	−0.33***	64	0.53	11	0.25	−0.28***
(13)	Share of Rank I teachers and lower	70	0.17	19	0.62	0.45***	64	0.17	11	0.50	0.33***
	Share of Rank III and above teachers among										
(14)	Share of the students in the sample	70	0.14	19	0.21	−0.07	64	0.23	11	0.09	−0.14
(15)	Female teacher share	70	0.59	21	0.86	0.27***	64	0.58	11	0.91	0.33***
(16)	Share of teachers with university degree	70	0.17	21	0.14	−0.03	64	0.19	11	0.18	−0.01
(17)	Share of teachers with professional college degree	70	0.61	21	0.34	−0.27***	64	0.60	11	0.38	−0.22
(18)	Years of teaching experience	69	14.78	21	12.66	−2.12	64	14.75	11	13.48	−1.26

Rows 14–18 report mean characteristics of teachers who taught the students in this sample.
All other rows report school average characteristics.
[a] Sample with full information (the analytic sample) indicates the sample with full information on the student and family characteristics, school resources, and teacher characteristics (the analytic sample used in the full-model regression analysis following Eq. (2) in the text).
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

might be one reason for the observed rural–migrant student achievement gap (Table 2). From the whole sample, we find that only 33% of migrant school students had repeated a grade (row 3, column 4). In addition, rural students had significantly more siblings than migrant students (rows 4 and 5, column 5). Having fewer siblings may confer an advantage since it could be that the student receives more parental attention as well as a larger share of household resources since there are fewer siblings to compete with. Of all the student and family characteristics we consider, rural students are superior to migrant students only in mother's education level (row 9, column 5). Summary statistics using the analytic sample also demonstrate patterns consistent with those using the whole sample (columns 5 and 10).

On the other hand, our data show that the school quality of migrant schools is inferior to that of rural public schools in most respects, thus potentially narrowing the achievement gap, rather than contributing to it. Our data show that rural public schools have better teachers than Beijing migrant schools. In migrant

Table 4
Possible sources of the rural–migrant student achievement gap.

Dependent variable: standardized math test scores	(1)	(2)	(3)	(4)
(1) Migrant school student	2.73***	2.87**	1.73*	4.51***
	[0.91]	[1.46]	[0.93]	[1.20]
Control variables				
Indicators of self-selection				
(2) Student and family characteristics		Y	Y	
Indicators of school quality				
(3) School resources and other characteristics		Y		Y
(4) Teacher characteristics		Y		Y
(5) Observations	3093	3093	3093	3093
(6) *R*-squared	0.00	0.05	0.04	0.01
(7) *F* tests				
Student and family characteristics: *F*-stat = 8.36; *P*-value < 0.005				
School resources and teacher characteristics: *F*-stat = 2.6, *P*-value < 0.005				

Robust standard errors in brackets.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.
The first row of each column reports the estimated rural–migrant student achievement gap conditional on the variables corresponding to the row names in the "control variables" panel.
The student and family characteristics included in column (2) are student gender, whether the student had repeated a grade, # of elder and younger siblings, respectively, whether the student is the only child of the family, each parent's years of education, # of meals eaten per day, and whether the student has any kindergarten experience.
The school characteristics included in column (2) are the age of the school, the age of the school's main building, an index of the availability of facilities (including computer lab, reading rooms, hot water, and school clinic), # of students, student–classroom ratio, student–school area ratio, and student–teacher ratio.
The teacher characteristics included in column (2) are the respective share of Rank III and Rank II teachers in the school, the share of female teachers in the school, the average years of teaching experience of the teachers who taught the sample students, the share of Rank III and above teachers of the teachers who taught the sample students, and the respective share of teachers with professional college and university degrees among the teachers who taught the sample students.
Columns (3) and (4) each control for the student and family characteristics (selection effect), and the school resources and teacher characteristics (school effect), respectively.

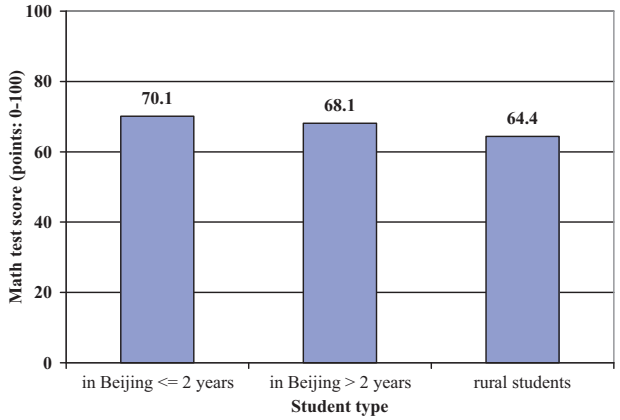

Fig. 3. Standardized math test scores by type of student.
Source: Authors' survey.

Table 5
The academic performance of migrant students and their length of stay in Beijing.

Dependent variable: standardized math test scores	(1)	(2)	(3)
(1) Time in Beijing < 2 years	1.99*	2.19*	2.62**
	[1.11]	[1.26]	[1.25]
Control variables			
(2) Student and family characteristics		Y	Y
(3) Migrant school dummies			Y
(4) Observations	931	679	679
(5) *R*-squared	0.00	0.15	0.05

Robust standard errors in brackets.
* Significant at 10%.
** Significant at 5%.
The first row of each column reports the estimated achievement gap between migrant students who have stayed in Beijing for less than two years and those who have stayed in Beijing for a longer period of time conditional on the variables corresponding to the row names in the "control variables" panel.
The student and family characteristics included in column (2) are student gender, whether the student had repeated a grade, # of elder and younger siblings, respectively, whether the student is the only child of the family, each parent's years of education, # of meals eaten per day, and whether the student has any kindergarten experience.
Column (3) controls for all variables in column (2) and the migrant schools attended by the students. The sample is restricted to migrant school students.

schools 62% of teachers are either Rank I or below (unranked), By contrast, only 17% of teachers in rural schools are Rank I or below (Table 3, row 13, columns 2 and 4). Teachers in migrant schools also have lower levels of education than those in rural schools: only 48% of teachers in migrant schools have a professional college or university degree (rows 16 and 17, column 4). In rural schools, 78% of teachers do (column 2). The analytic sample shows patterns similar to those found in the whole sample (rows 11–18, columns 5 and 10).

Besides lower teacher qualifications, migrant schools also have inferior resources when compared to rural schools. Although migrant schools have been operating for fewer years than rural schools, their school buildings are, on average, three years older than rural schools (Table 3, rows 1 and 2). In addition, the student–teacher ratio in migrant schools is nearly 58% higher than that in rural schools using the whole sample and 38% higher using the analytic sample (row 5). Although the differences are not always statistically significant, resources such as computers, hot water and school clinics are also less available in migrant schools (rows 7, 9 and 10).

3.3. Multivariate analysis

The results of our multivariate analysis are mostly consistent with the descriptive analysis. When running the simple model in Eq. (1), migrant students in Beijing migrant schools significantly outperformed rural students by 2.7 points on the standardized math test (Table 4, row 1, column 1).

The results also show that both selection and school effects are important factors for the migrant-rural student achievement gap, yet they act in opposite direction. When we control for both the

Table 6
Summary statistics of student and family characteristics by student type.

	Variable	Migrant students in migrant schools		Migrant students in public schools		Local Beijing students in public schools	
		(1)	(2)	(3)	(4)	(5)	(6)
		Obs	Mean	Obs	Mean	Obs	Mean
(1)	Female	931	0.44	268	0.51	159	0.42
(2)	Age	877	10.61	264	10.41	156	10.30
(3)	Repeated a grade	931	0.33	259	0.17	155	0.10
(4)	# of elder siblings	922	0.76	253	0.52	136	0.69
(5)	# of younger siblings	923	0.62	250	0.55	136	0.33
(6)	Only child	931	0.22	268	0.40	159	0.57
(7)	# of meals/day	847	1.89	256	1.95	151	1.91
(8)	Father's education (years)	750	8.78	260	8.81	83	9.31
(9)	Mother's education (years)	775	8.09	265	8.64	85	9.16
(10)	Never attended a kindergarten	931	0.43	268	0.20	159	0.12

Source of data: Authors' survey.

selection factors and school quality indicators in the estimation model (Eq. (2)), the estimated rural–migrant student achievement gap does not fall (Table 4, row 1, column 2). However, when we ran the model in Eq. (2), except for controlling for the selection effect and school effect separately, we find that both selection and school effects are by themselves significant at the 0.01 level according to the *F*-test of joint significance (Table 4, row 7). Pushing the analysis further, when including only the selection factors, i.e., student characteristics and family background (X_i) as control variables into Eq. (1), we find that the estimated rural–migrant student achievement gap drops sharply. The point estimate of the rural–migrant student achievement gap drops to 1.7 points (Table 4, row 1, column 3); the level of significance also drops. When we include school resource measures and teacher characteristics (S_s, T_{sc}) alone into Eq. (1) as control variables, the achievement gap, instead of dropping, significantly increases to 4.5 points (Table 4, row 1, columns 4).

3.4. The academic performance of migrant students and their length of stay in Beijing

Comparison among migrant students with different lengths of stay in Beijing provides additional support for the notion that migrant schools hold back student achievement. If the poor quality of migrant schools hurts student performance, we would expect that among migrant students in the same grade, those who recently moved to Beijing might not be as negatively impacted as those who have been in Beijing longer.

In fact, our data do show deteriorating performance over time for migrant students. Migrant students who had lived in Beijing for under two years before entering fourth grade had a mean math test score of 70.1 points (Fig. 3). These recent migrants significantly outperform migrant children who have lived in Beijing for longer than two years by two points (70.1 points versus 68.1 points—Fig. 3). Results about the relationship between the length of stay in Beijing and academic performance are robust to alternative specifications and different approaches to the analysis. We have tried different cut-off points of the length of stay in Beijing, comparing migrant students who have lived less than one year, two years, three years and four years in Beijing, respectively, to those who have lived in Beijing for longer than the respective period of time. In all cases, we find that migrant students who have lived in Beijing for shorter periods of time outperform those who have lived in Beijing for longer periods.

Results from the regression analysis are also consistent with our findings in Fig. 3 (Table 5, row 1, column 1). The estimated achievement gap between migrant students who have lived in Beijing for under two years and those who have lived in Beijing for over two years is still significant and positive when accounting for differences in student and family characteristics and the quality of migrant schools (row 1, columns 2 and 3).

3.5. Do migrant students perform better in Beijing public schools?

Since migrant schools do not provide quality education to migrant students, one question naturally arises: Does the performance of migrant students improve when they enroll in Beijing public schools? Despite its importance, there has been no conclusive answer to this question. There are two possible reasons for this. First, the decision to enroll one's child in a migrant or public school is not exogenous and is itself influenced by many student and family characteristics. Hence, the endogeneity of school choice makes it difficult to separate the true effects of school type (migrant versus public schools) on the student performance from the influences of the student and family characteristics that affect both the school choice and student academic performance. Second, data availability is highly limited. Public schools in Beijing rarely allow data collection efforts from academics.[7]

According to our test score data, migrant students in public schools significantly outperform migrant students in migrant schools. Migrant students who attend public schools had an average test score of 80.3 on a scale of 100 (Fig. 4). This score was more than 10 points higher than that achieved by migrant students in Beijing's migrant schools and by rural students in Shaanxi. This result is consistent with the findings of Song et al. (2010). Interestingly, the mean test score of local Beijing students in these four public schools is only 79.3. This is slightly lower than that of migrant students in the same public schools.

Descriptive and multivariate analysis further demonstrate that self-selection cannot be the only reason for the achievement gap between migrant students in Beijing public schools and those in migrant schools, which suggests that attending public schools would likely be beneficial to the academic performance of migrant students. According to our data, migrant students in public schools have significantly stronger individual and family backgrounds than migrant students in migrant schools (Table 6, rows 3, 6, and 8–10), indicating positive selection into public schools among migrant students. However, when we run a multivariate regression to estimate the achievement gap and control for student and family characteristics (and thus the selection effect), the estimated

[7] The only existing study that systematically compares migrant students' performance in public schools with that in migrant schools is Song et al. (2010). They compiled a unique data set containing information on students in 49 migrant schools and 43 public schools in Beijing. Benefiting from this rich data set, they used propensity score matching to identify the relationship between school type and migrant student performance. They found that attending a public school was significantly and positively associated with migrant students' academic performance.

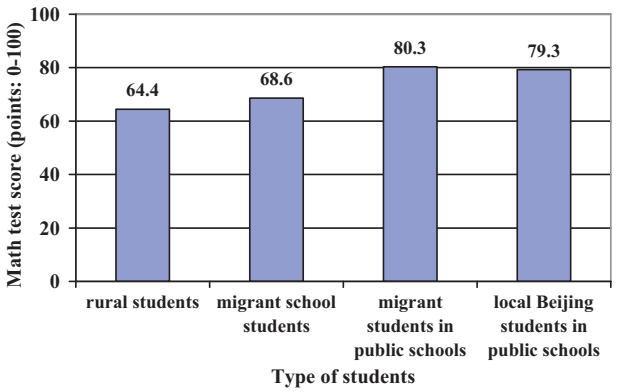

Fig. 4. Comparison of the mean standardized math test scores among different types of students.
Source: Authors' survey.

achievement gap only slightly decreases compared to the unconditional achievement gap. Moreover, the conditional achievement gap is still highly significant at the 1% level (results not reported here).

3.6. Discussion

Based on the empirical evidence above, we find that migrant students significantly outperform students in poor rural areas academically, and that both the selection effect and school effect play important roles in the rural–migrant student achievement gap, though in opposite directions. On the one hand, children with stronger academic and family backgrounds are more likely to follow their migrant parents to Beijing. Therefore self-selection into migrant schools drives up the achievement gap between rural and migrant students in favor of migrant students. On the other hand, the school effect diminishes this gap as a result of the inferior school resources and lower teacher qualifications in migrant schools. This explains why we do not observe significant change in the estimated rural–migrant student achievement gap when controlling for both the selection effect (student and family characteristics) and the school effect (school resources and teacher characteristics) simultaneously.

Therefore, one interpretation of our finding is that the low quality of school resources and teachers in migrant schools has diminished the academic progress of the migrant students. Migrant students apparently outperform rural students only because they have stronger academic and family backgrounds. Had school resources and teacher quality been equal between the migrant and rural schools, migrant students would have outperformed rural students by an even greater margin than what we have observed in our data. Additional evidence also shows that the longer a student stays in Beijing migrant schools, the poorer his/her academic performance.

According to our empirical analysis, access to the urban public schooling system might be a solution to the substandard educational quality of the migrant students. Our analysis shows that migrant students who attend even the poorest Beijing public schools significantly outperform students in migrant schools. And this advantage persists even after controlling for the selection effects. Of course, future research with more representative sample of Beijing public schools would be desirable to make this argument more solid.

4. Conclusions

In order to understand the nature of the education system of migrant children in Beijing, we empirically examined the academic performance of migrant students in migrant schools and compared it to that of students in rural public schools in Shaanxi Province and to migrant students in urban public schools in Beijing. We also explored the determinants of migrant student performance. Using both descriptive and multivariate analysis, we find a significant achievement gap between migrant students and rural students: migrant students in Beijing outperform rural students in Shaanxi by 2.7 points (0.3 standard deviation of the distribution of test scores) on a standardized math test.

Our data suggest that this achievement gap is mainly driven by two things: self-selection and school effect due to the fact that migrant students lose ground to rural students as a result of poor school resources and low teacher quality in migrant schools. We find that migrant school students have stronger academic and family backgrounds than do poor rural students. However, school resources and teacher qualifications in migrant schools are inferior to those in even the poorest rural schools. Multivariate analysis further confirms that the selection effect significantly increases the rural–migrant school student achievement gap and that this achievement gap would be even wider if the school resources and teacher qualifications in migrant schools were as good as those in poor rural schools.

Using survey data collected from a sample of Beijing public schools, we show that migrant students in public schools significantly outperform their counterparts in migrant schools. Moreover, although our data show that migrant students with stronger academic and family backgrounds are more likely to be admitted to public schools in Beijing, a multivariate analysis shows that differences in student and family characteristics only explain part of the achievement gap between migrant students in migrant schools and those in public schools. In other words, the public schools themselves are likely an important contributor to the superior academic performance of migrant students attending those schools.

Our results have important implications for the education of China's migrant children. Adequate academic progress will better prepare migrant children for the demands of the future labor market, which, in turn, is central to China's future social stability and sustainable economic development. According to our data, however, migrant schools, the main venue for the education of migrant children, have been unsuccessful in delivering quality education to migrant children, while urban public schools have been unable to accommodate many migrant children, the number of which is growing rapidly.

In order to improve the educational performance of migrant students, urban school systems should commit themselves to an ambitious expansion program that will allow any student in China's cities to receive a public education, regardless of hukou status. Although this is an expensive proposition, the importance of providing migrant students with a high quality education should make it a priority. It also has to be realized that this commitment is a long-term one, as migration will undoubtedly continue in the coming decades. It is almost certainly the case that providing quality education in cities will accelerate migration—at least in the short run. Far from being a reason for China not to do this, it is an opportunity to raise the human capital of millions of students, who one day will become key players in China's labor markets.

However, even if China makes a policy decision to provide urban public education for all migrant students, change will not likely to happen overnight. Therefore, migrant schools almost certainly will remain one of the major educational resources for migrant children. As a result, our results suggest that one way for policymakers to improve infrastructure and teaching resources in migrant schools would be to invest public resources into migrant schools to improve facilities and teacher quality.

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