

Draft: March 2008

The Effect of Migration on Children's Educational Performance in Rural China

Xinxin Chen^{*}
Associate Professor
Zhejiang Gongshang University

Qiuqiong Huang
Assistant Professor
Department of Applied Economics
University of Minnesota

Scott Rozelle
Professor and Helen Farnsworth Senior Fellow
Freeman Spogli Institute
Stanford University

Yaojiang Shi
Professor
College of Management, Northwest University
Xian, China

Linxiu Zhang
Deputy Director and Professor
Center for Chinese Agricultural Policy
Institute of Geographical Sciences and Natural Resource Research
Chinese Academy of Sciences

*Corresponding author

Xinxin Chen

Mailing address: College of Economics
Zhejiang Gongshang University
149 Jiaogong Road,
Hangzhou 310035, China

Tel: 86-571-88211232

Fax: 86-571-28008035

E-mail: xinxchen@yahoo.com

The Effect of Migration on Children's Educational Performance in Rural China

Abstract

Migration is widely known as one of the main ways of alleviating poverty in developing countries, including China. However, migration is not costless. In recent years, researchers have raised concerns about the potential negative effects of migration on the educational achievement of the school-aged children that are left behind in rural villages when one or both of their parents outmigrate to cities for work. This paper examines whether there is a negative relationship between educational achievement of students and the migration activities of their parents. Utilizing a set of panel data, we examine changes in school performance of children before and after their parents outmigrate. In the analysis we use Difference-in-Difference, Matching and Difference-in-Difference Matching estimators. Somewhat surprisingly, we find that there is no significant negative effect of migration on the school performance of students. In fact, we find that educational performance improves in those migrant households in which the father outmigrates.

JEL: I22; O12; O15

Keywords: migration; school performance; rural China

The Effect of Migration on Children's Educational Performance in Rural China

Migration is widely known by researchers and policy makers as one of the main ways of alleviating poverty in developing countries (Todaro, 1989). Many positive effects have been identified. Having a migrant may increase a household's income per capita significantly (e.g., Du, Park and Wang, 2005). Migrant remittances have been shown to help reduce income inequality in countries such as China and Mexico (e.g., Benjamin, Brandt and Giles, 2005; McKenzie and Rapoport, 2007). Increases in outmigration can lead to increased investment in assets related to agricultural production and other investments in source communities (de Brauw and Giles, 2007). Giles (2006) shows that access to migration offers a risk-coping mechanism that allows households to reduce the variability of income caused by shocks affecting agricultural production.

Migration itself, however, is not costless. In recent years, a group of researchers have raised concerns about the potential negative effects of migration on the educational outcome of the school-aged children that are left behind in rural villages when one or both of their parents outmigrate to cities for work. McKenzie and Rapoport (2006) found that children in migrant households are less likely to be attending school and complete fewer total years of schooling than children in non-migrant households. One of the main reasons may be that migration results in significantly less parental supervision of school attendance and the loss of any positive influence through learning at home (Hanson and Woodruff, 2004). There may be other effects. For example, students may have less time to spend on studying since they have to do more housework when one or both parents outmigrate. Similar findings of adverse effects of

migration on children's schooling are also observed in the Philippines (Battistella and Conaco, 1998) and in Sri Lanka (Shaw, 2005).

On the other hand, researchers have also found positive relationship between migration and education of migrant children. Remittance transfers, by relaxing a household's liquidity constraint, allow investment in education and thereby can increase educational attainment of children in migrant households. For example, Cox Edwards and Ureta (2003) found that receiving remittances reduces the likelihood of quitting school among individuals aged six to 24 years in El Salvador. Similar arguments are also found in Glewwe and Jacoby (2004), Lopez-Cordova (2005) and Yang (2005). In addition, migration, by increasing household income, can contribute positively to child development (Blau, 1999; Duncan, Brooks-Gunn and Klebanov, 1994; Hanushek, 1992; Korenman, Miller and Sjaastad, 1995; Wolfe, 1982). Overall, migrant children could benefit from the positive income effect of migration.

The impact of migration on the educational performance of children that are left behind is also an important and emerging issue in China. The migrant labor force has been growing rapidly since the 1990s in China, surpassing 100 million individuals (de Brauw, et al., 2002). Migrants also are moving further away from home and leaving for a longer period of time (Rozelle, et al., 1999). Since most of China's migration is by individuals instead of entire households, in most cases the school-aged children are left behind in the village when their parents move to the city for work (Wu, 2004). Several researchers have claimed that school performance of migrant children is adversely affected (Li, 2004; Tan and Wang, 2004; Wang and Wu, 2003; Zhou and Wu, 2004).

If migration indeed has a negative impact on education of the next generation, the government may want to respond. For example, the government might want to allocate funds to

build more boarding schools that offer some of the services that parents originally carried out before they entered the migrant labor force. Alternatively, education officials can improve the environment in rural schools so that teachers could pay more attention to students in schools in which there were many children of migrants, which can be done by reducing class sizes or hiring more qualified teachers. More schools could also be built in urban areas that welcome the children of migrants. In the long run, the government probably should start to modify education policies to favor children of migrants (Heckman, 2005). However, all of these public investments, programs or policy changes will be costly and so they are only justified if the cost of migration far exceeds its benefit. Somewhat surprisingly, despite its importance, little work has been done to understand whether or not migration hurts the educational performance of children.

The overall goal of this paper is to examine the effect of migration activities of parents on the educational performance of their children. A better understanding of this issue will provide policy makers with the information they need to decide whether to change the school systems and childcare systems in China's rural and urban areas. To meet the overall goal, we will pursue three specific objectives. First, we compare the distribution of children's scores across different types of households (migrant and non-migrant households) and over time (before and after one or both parents outmigrate). Second, we examine whether migration negatively affects the school performance of migrant children. Third, we explore whether the effects of migration on children's school performance are heterogeneous among different groups of households that differ in terms of wealth or demographic composition.

This study is unique in several respects. First, it contributes to the literature on migration and rural human capital investment in source communities by examining how children's scores

respond to the migration activities of their parents. To date this literature is relatively small and is focused largely on the impact of migration on educational attainment often measured by years of schooling (e.g., Cox Edwards and Ureta, 2003; Hanson and Woodruff, 2004; McKenzie and Rapoport, 2006). Only a few studies have touched on the impact of migration on school performance of children (e.g., Kandel and Kao, 2001). Second, unlike most studies that only have access to cross sectional data, our paper utilizes panel data from a survey designed specifically to examine changes in school performance of children before and after their parents outmigrate to cities for work. The use of panel data helps us eliminate some statistical problems that may arise from relying on cross sectional data. For example, it could be that the children of migrant households perform more poorly in school, not because their parents leave, but that their grades were systematically lower to start with (Ye, et al., 2006). Third, we use the most up-to-date evaluation methods, instead of relying on OLS estimates. In our analyses, we use the Difference-in-Difference estimator, matching estimators (Propensity Score Matching and Bias Corrected Matching) and the Difference-in-Difference Matching estimator.

There are several limitations in our study. We only focus on students and their families from one small, poor part of China. This limits our ability to generalize our findings to the whole China. Moreover, despite our efforts to account for unobserved heterogeneity that may affect both migration decisions and educational performance, we do not have access to instrumental variables that can hold constant the time varying unobservable factors. Consequently, it is possible that we are carefully measuring correlations but not causal effects. However, we believe that even knowing correlations is important for policy makers, making this study valuable nonetheless.

Data

The data used in this paper come from a survey conducted by the authors in 2006. The sample was drawn from 36 primary schools in 12 townships in Shaanxi province, one of the nation's poorest provinces. The sample was drawn using a four-stage clustering design with random sampling procedures employed at each stage. In the first stage, six counties were selected from 93 counties in Shaanxi province. In the second stage, after ranking all townships in the county according to per capita income, the survey team randomly selected two townships: one from relatively rich townships and the other from relatively poor townships. In stage three, three primary schools were randomly chosen from a list of all primary schools with six years of schooling (or all *wanxiao*) in each township.

The sample students were selected during the final stage of the sampling. The sample included all students that were in the entering year of the sixth grade classes in each of the sample schools. On average, there were 1.4 sixth grade classes per school, ranging from one to three. Since the survey was conducted in September and the school year in China runs between early September and mid-July, all of the sample students had just completed the fifth grade about two months ago. In total, the sample included 1,649 children and their families. Approximately 45 percent of the sample students were girls. The ages of the students ranged between 10 and 16.¹ In addition, since we sampled from the population of students that made to the sixth grade, we did not track down those that either dropped out or accompanied their parents to the city before the sixth grade. Fortunately, according to the information from the school sections in our survey questionnaire, this is not a serious problem. The drop out rate in our sample is low. More than 98 percent of the children that started first grade were still in school in the sixth grade.²

In addition to interviewing students directly, we also elicited information about the students from their homeroom teachers (or *banzhuren*). In more than 90 percent of the cases, the homeroom teacher had been with the students for at least two years. In China homeroom teachers are in charge of administering students' school program in addition to teaching one or two subjects. They are the interface between the students and the principal's office. They also coordinate between students and their parents. Many homeroom teachers make a point of visiting the homes of their students. Therefore, in most cases the homeroom teacher was intimately familiar with the school performance and family life of each student.

The measure of one of the key variables, educational achievement, is based on the Math and Chinese language scores of the students from the calendar year 2001/2002 (the year students were in the first grade) to 2005/2006 (the year students were in the fifth grade).³ Fortunately, students in all the sample schools keep in their possession a booklet that records their Math and Chinese scores for each semester during their schooling. The scores were copied by our enumerators with the assistance of the homeroom teachers. Therefore, the educational achievement variables are measured with great accuracy since they are record-based, not from recall data.

In our analyses, we use the second term (or the spring semester) Math and Chinese language scores to measure educational achievement because they are based on standardized tests. The tests are standardized in two dimensions. First, the questions are the same for all schools within the same township. Second, the final exams were graded according to the same set of criteria by a township-wide panel of teachers. The results of our analyses, however, do not depend on the choice of using the second term scores from the first and fifth grades. As a robustness check, we also used average scores for the whole year instead of just for the second

semester. In another check, we compared scores that averaged scores from first AND second grade to scores that averaged scores from fourth and the fifth grade. Our results remain largely the same in these cases.

In order to measure another key variable, the migration status, we collected detailed information on the migration histories of each student's family. The first set of information came from the survey questionnaire that was filled by students and their family with the supervision of enumerators. In the questionnaire, we have a section that asked for the migration status of each parent during the first grade and during the fifth grade. If the parents were both out of the village, we called one of the parents and asked them these questions over the telephone. As a way of cross checking, the homeroom teacher was asked to verify the information on migration status. If the homeroom teacher was not present during the first grade, we consulted the personnel in the office and asked about the attendance of parents at parent-teacher meetings that are held during each term.

Based upon migration status, there are two types of households in this study: *Migrant households* (or those households in which at least one parent outmigrated during the period between 2002 and 2006) and non-migrant households. Recognizing that the effect of migration on student performance may be affected by *which family member* outmigrates (that is, father, mother or both), we further subdivided the Migrant households into six types of households: *Any Parent Migrated* households (that is, households in which both parents lived at home in 2002 and at least one parent—either the father; mother or both parents—outmigrated by 2006); *Father Migrated Only (or mother-stayed-at-home)* households where only the father outmigrated by 2006 but was at home in 2002; *Father Migrated (Unconditional)* households where the father was at home in 2002 but outmigrated by 2006 (including households in which the mother was

either at home or not at home in 2006); *Mother Migrated Only* (or *father-stayed-at-home*) households where only the mother outmigrated by 2006 but was at home in 2002; *Mother Migrated (Unconditional)* households where the mother was at home in 2002 but outmigrated by 2006 (including households in which the father was either at home or not at home in 2006); and *Both Parents Migrated* households where both parents were at home in 2002, but outmigrated by 2006. It should be noted that the six types of households are not mutually exclusive. For brevity, when we talk about all of these households as a group, we call them *New Migrant* households to distinguish them from households that were already in the migrant labor force in 2002. The latter sample households are not included in our study. In addition, for the non-migrant households, we define *Never Migrant* households as those where both parents stayed at home in both 2002 and 2006.

In addition to educational achievement and migration status, we also collected information on variables that can help us explore whether the effects of migration on the school performance of children are heterogeneous across households that are different in several aspects. First, as family wealth may improve the learning outcomes of students (Brown and Park, 2002), we asked the parents if their house was worth more than 5,000 yuan or not as a proxy for family wealth.⁴ Admittedly, this is a crude measure of wealth. However, given that our sample size is larger than 1,600, financial and time constraints dictated that we used this measure instead of implementing a long questionnaire to collect detailed information on income and assets from all different sources as well as information on consumption. Second, since previous studies have also documented the effect of the number of children in a family on the school performance of each child (e.g., Hanushek, 1992; Nuttall, et al., 1976; Steelman and Mercy, 1980), we collected information on whether a student had any siblings or not and the number of siblings.

Finally, we also collected information on other variables that may affect school performance and parents' migration decision. We collected information on each student's gender, age, whether or not they were student cadres, whether they have mentors to help them study. The survey questionnaire also included questions on the characteristics of parents and households: each parent's age, educational attainment, the household's land holdings and the total number of other household members.

Migration and Educational Performance

Similar to the migration status in many other poor rural areas in China (as found in Rozelle, et al., 1999), many households in our sample were already in the migrant labor force in 2002, the first year of our sample. In 236 households or about 15 percent of the 1,594 households in our sample, either one parent or both parents migrated (Table 1, column 1, row 1 – 3). In most migrant households, the father was the parent that outmigrated. In 149 households, the father migrated in 2002 while the mother stayed at home.⁵

Also similar to the migration trend in the rest of China (as reported in de Brauw, et al., 2002), the number of new migrant households rose rapidly during the period between 2002 and 2006. Among the 1,358 non-migrant households in 2002 (column 1, row 4), one or both parents in 220 households entered the migrant labor force between 2002 and 2006 (row 4, column 2 – 4). After subtracting the 81 households that migrated in 2002 but returned to the village in 2006 from the 220 New Migrant households (column 5, row 1 – 3), the total migrant households rose to 375 households in 2006 (row 5, column 2 – 4). This is a nine percent increase from the 2002 level of migration.

More than 70 percent of the households did not participate in migration activities at all during this period (column 5, row 4). The existence of these non-migrant households as well as new migrant households offers a unique opportunity to examine the relationship between the migration activity of parents and the school performance of children. In the rest of the paper, we will focus on comparing the school performance of the children of the 1,138 Never Migrant households and those of the 220 New Migrant households.

If one were naively to have sought out parents of New Migrant households and asked them for the record of their children's scores over years, one would likely have found that the scores have fallen since the first grade. It is understandable how the findings of such an inquiry could raise concerns about the potential negative impact of migration on school performance. However, the falling scores may not be a problem that can be solely blamed on migration. As our data show, not only have the scores of the students from the New Migrant households fallen, but also have those from other households including non-migrant households fallen (Figure 1). As can be seen in Figure 1, this is true for both Math and Chinese scores. A simple t test shows that the means of the scores in 2002 and in 2006 are significantly different. When asking teachers about this trend, we were told the pattern of falling scores is easily explained by two factors: 1) The materials covered in the fifth grade are much more advanced and difficult than those in the first grade; and 2) In general the fifth grade teachers grade harder than the first grade teachers. Since these two factors affect students from both New Migrant and Never Migrant households, the general trend of falling scores is not surprising and clearly cannot be solely attributed to parents' migration activities.

If the interviewers had sought out Both Parents Migrated households or Mother Migrated households, the results of interviews might raise an additional source of concern about the effect

of migration on the grades of the children of new migrants. In our sample, students from Both Parents Migrated households had lower average test scores during their fifth grade year than those from Never Migrant households (Figure 2). Similar results were found in a number of Chinese studies (e.g., Li, 2004; Tan and Wang, 2004; Wang and Wu, 2003; Zhou and Wu, 2004). Although the difference is not statistically significant, the fifth grade scores of the children of Mother Migrated (Unconditional) households were also lower than those of Never Migrants. While we will explore this result further in the forthcoming analyses, it may be that it is these types of findings, which appear in our cross section of fifth grade households, have made the effect of migration on school performance a high profile issue. Interestingly, if the interview team had chosen Father Migrated (Unconditional) households, they would have found that on average scores of children from these households were slightly higher than those from Never Migrant households. The differences in the relationship between students' scores and parents' migration activities among different types of households indicate that the effect of migration on school performance is a complicated issue and those relying exclusively on cross sectional data should exercise caution in any interpretation.

The need to exercise caution is reinforced when we compare the first grade scores in 2002 in addition to comparing the fifth grade scores in 2006. Although students from Both Parents Migrated households scored lower than those from the Never Migrant households in 2006, Figure 3 shows they already scored lower in 2002 when they were in the first grade. In other words, on average the scores of the students from Both Parents Migrate households were already lower *before their parents migrated*. This finding from our panel data indicates we should not jump to the conclusion that migration hurt children's school performance. Moreover, the distribution of the scores of the non-migrant children moves closer to that of the migrant

children over years. The distribution of the scores of non-migration students shifts to the left in contrast to its distribution in 2002 (a higher peak in the middle and thinner tail at the upper end). Although the distribution of the scores of migrant children has a thicker tail at the lower end in contrast to its distribution in 2002, its distribution does not shift as much as that of non-migrant children. Overall, it appears that the gap between the scores of migrant children and non-migrant children actually was narrowing slightly between 2002 and 2006. From this seemingly narrowing gap, one might infer migration helps improve school performance. Furthermore, t tests show that the means of the two distributions are not statistically significant either in 2002 or in 2006.

Further analyses of our data reveal that school performance may be explained by many factors other than migration activities. These factors may change over time and differ between migrant and non-migrant households. More importantly, these variations may be masking the relationship between migration and school performance. For example, as mentioned earlier, difficulty of class materials and teachers' grading attitude change over time, which affect students' scores. In addition, school performance may differ by a household's wealth—or more specifically in our study, the value of the housing assets of the household.⁶ Students from wealthier households score systematically higher than those from poorer households (Figure 4, Panel A). This result is consistent with previous findings that the grades of children from better off families often are higher since these children have access to better nutrition and better studying facilities, including access to extra reading materials and exercise books (Princiotta, Flanagan and Hausken, 2006). The students from wealthier households also may have less housework to do than their less wealthy counterparts so that they may spend more time studying, which might also lead to higher scores.⁷

Grades may also differ among households with different household demographic compositions. Students from households in which there are no siblings scored slightly lower than those from households with siblings in 2006 (Figure 4, Panel B). Such a finding is consistent with Brown and Park's study (2002), which found that children with older siblings have significantly higher test scores than their peers. It is possible that the scores of these children are higher because students without any siblings are unable to receive help from their siblings on schoolwork or because they have no siblings that they can share the burdens of household duties together.

If either a household's wealth or demographic composition differs systematically with a household's migration status, two-way correlations between a family's migration status and the grades of its children could be misleading. For example, de Brauw and Giles (2007) find that migrant households, while poorer, improve their family's income status after migration. Higher income could have a positive effect on the grades of migrant children over time that might offset any other adverse effects. Therefore, further analyses are needed to explore the impacts of migration on educational achievement while holding as many other factors constant as possible.

Methodology

The objective of this study is to evaluate the effects of the migration activities of parents on children's educational performance. In the following analyses, we will employ methods that are widely used in the program evaluation literature as well as some recently developed evaluation methods. In our study, migration is considered as the treatment. In particular, we are interested in the "average treatment effect on the treated" (ATT). Following Smith and Todd (2005), ATT is calculated as:

$$ATT = E[Score_1 - Score_0 | Mig = 1] \quad (1)$$

In equation (1), $Score_1$ denotes students' school performance (the outcome variable) conditional on parents' participation in migration activities. $Score_0$ denotes students' school performance conditional on parents' non-participation in migration activities. The dummy variable, Mig , takes the value of one for households in which either or both parents outmigrate (the treatment group) and zero for non-migration households (the control group). The treatment group in our study refers to either one of the six types of New Migrant households: Any Parent Migrated; Father Migrated Only; Father Migrated (Unconditional); Mother Migrated Only; Mother Migrated (Unconditional); and Both Parents Migrated. The control group includes all the Never Migrant households. With only nonexperimental data at hand, we do not have a direct estimate of the counterfactual mean for the treatment group, $E[Score_0 | Mig = 1]$.

The difference-in-difference (DD) estimator measures the difference between students from New Migrant households and students from Never Migrant households in their before-after school performance. Let t' and t denote time periods before (2002) and after (2006) the change of migration status. The standard DD estimator is given by:

$$DD = E[Score_{1,t} - Score_{1,t'} | Mig = 1] - E[Score_{0,t} - Score_{0,t'} | Mig = 0] \quad (2)$$

In the difference-in-difference estimation, instead of using a direct estimate of the counterfactual mean of the before-after difference for the treatment group, $E[Score_{0,t} - Score_{0,t'} | Mig = 1]$, the before-after difference for the control group, $E[Score_{0,t} - Score_{0,t'} | Mig = 0]$, is used. The implicit assumption is that absent the change in migration status, the average before-after difference in school performance would be the same for the control group and the treatment group. Formally, this is called the “parallel trend” assumption, which is expressed as:

$$E[Score_{0,t} - Score_{0,t'} | Mig = 1] = E[Score_{0,t} - Score_{0,t'} | Mig = 0] \quad (3)$$

In addition to implementing the standard DD estimator just described in equation (3), we also implement the unrestricted version and the adjusted version. An unrestricted model includes $Score_{0,t'}$ as a right hand side variable. This removes the restriction in the standard DD model that the coefficient on $Score_{0,t'}$ equals one. An adjusted model includes other covariates in addition to the treatment variable. In total, four models are estimated: the restricted and unadjusted model (the standard DD estimator), the unrestricted and unadjusted model, the restricted and adjusted model and the unrestricted and adjusted model.

The consistency of the DD estimator depends on the validity of the parallel trend assumption. The more similar are the treatment and control groups, the more convincing is the DD approach. Our data show that most observable covariates are not statistically significantly different across the control group and the treatment group. The summary statistics for the Never Migrant households and the Any Parent Migrated households are reported in Appendix Table 1. This finding suggests that the parallel trend assumption may hold if there are not large differences in the unobservable factors.

An alternative method of program evaluation is matching. Matching estimators match a student in the treatment group with an observably similar student from the control group and interpret the difference in their school performance as the effect of the parents' migration activities. The key assumption underlying the matching estimator is the Conditional Independence Assumption (CIA), which states that non-participation outcome, $Score_0$, is independent of parents' migration status after conditional on a set of observable characteristics (Rosenbaum and Rubin, 1983).

The propensity score matching (PSM) estimator is the most popular matching estimator used to evaluate programs. PSM matches students from the treatment groups and the control

groups with similar propensity scores. The propensity score, $p(Z)$, is defined as the conditional probability that parents participate in migration activities, $\Pr(Mig = 1 | Z)$. The vector Z is a set of observable covariates that influence parents' migration decision. In PSM, a weaker version of the CIA is used, $E[Score_0 | Mig = 1, p(Z)] = E[Score_0 | Mig = 0, p(Z)]$. That is, by matching students with similar propensity scores, any differences in $E[Score_0]$ between the New Migrant households and the Never Migrant households are assumed to drop out since migration status, after conditional on $p(Z)$, does not affect $Score_0$. Following Smith and Todd (2005), the PSM estimator of ATT is calculated as:

$$\begin{aligned} ATT &= E[Score_1 - Score_0 | Mig = 1, p(Z)] \\ &= E[Score_1 | Mig = 1, p(Z)] - E[Score_0 | Mig = 0, p(Z)] \end{aligned} \quad (4)$$

In our analyses, Z includes covariates that capture the characteristics of students, parents and households. We also include township fixed effects to control for unobservable factors at the township level that may affect migration.

We follow a series of steps when implementing PSM (Caliendo and Kopeinig, 2008). First, since matching is only justified over the common support region, we check whether there is a large overlap in the support of the covariates, Z , between the New Migrant and Never Migrated households. In our study, we use propensity scores as a tool to enforce a common support. Fortunately, the common support is fairly wide in our sample.⁸ So we can use a large portion of the sample to calculate ATT. In the second step, we choose the method of matching. In our analysis, we use the nearest neighbor matching method with replacement. Following Smith and Todd (2005), we match students based on the log odds-ratio and standard errors are bootstrapped using 1,000 replications. The last step is to assess matching quality. Since we do not condition on all covariates but on the propensity score alone in PSM, it has to be checked if

the matching procedure is able to balance the distribution of the relevant covariates in both the control and treatment group. To do so, we use balancing tests described in Dehejia and Wahba (1999; 2002). The balancing tests were satisfied for all covariates.

Although the PSM with nearest neighbor matching with replacement has been widely used and seems to work well in our data, several potential problems have been raised in Abadie and Imbens (2006). First, when matching is not exact, the matching estimator may be biased. For example, Heckman, Ichimura and Todd (1997) has identified geographic mismatch between matched observations as a source of bias. Abadie and Imbens (2002) show that the “matching discrepancies” (the difference in covariates between matched units and their matches) also leads to bias in the matching estimator. Since PSM matches observation based upon propensity scores instead of multiple covariates, both geographic mismatch and matching discrepancies could be present and cause biases. In addition to the potential bias in the estimator, Abadie and Imbens (2006) also show that, due to a lack of smoothness, bootstrapping fails to provide consistent estimates of the errors when the matching method is nearest neighbor matching with a fixed number of matches.

In order to guard against the above mentioned potential sources of biases, we also implement the *Bias Corrected Matching* estimator developed by Abadie and Imbens (2006).⁹ The bias corrected matching estimator uses a regression based approach to adjust for matching discrepancies. With the bias adjustment, the matching estimator can be shown to be consistent. Furthermore, instead of using bootstrapped standard errors, Abadie and Imbens (2006) developed a variance estimator that is consistent and also allows for heteroskedasticity in the treatment effect. Unlike PSM, the biased corrected estimator allows for matching over a multi-dimensional set of covariates. It also allows exact matching (or as close as possible) on a subset of variables.

This property enables us to enforce exact matching by township in order to minimize geographic mismatch.¹⁰ When selecting the number of matches in the nearest neighbor matching with replacement, we match each treatment observation to three control observations, which is few enough to enable exact matching by township for nearly all observations but also enough to reduce the efficiency loss significantly (Abadie and Imbens, 2006).

Since all matching methods only match observations based upon observable covariates, they do not account for all unobservable covariates. In our analysis, even though we are able to control for unobservable factors at the township level that are correlated with the observables using fixed effects when estimating the propensity score, there may still be systematic differences between the New Migrant and Never Migrated households that are due to unaccounted for unobservables. The systematic differences could arise, for example, because the household's decision to migrate is based on some unmeasured household characteristics. For example, parents in households which believe that their child will be little affected when one or both of the parents leave may be more inclined to outmigrate; while parents in households which believe that their child will be negatively affected when one or both of the parents leave may be less inclined to migrate. Matching estimators are not robust against these types of potential "hidden biases" (Rosenbaum, 2002). We also discuss the issue of potential sources of endogeneity further in the conclusion section.

To control for part of the unobservable factors, in particular, those factors that are time-invariant, we extend the cross-sectional matching estimator to a longitudinal setting and implement a difference-in-differences matching (DDM) estimator. With DDM we can exploit the data on the Migrant households in 2002 to construct the required counterfactual, instead of just using the data in 2006 (as is used in matching). The DDM estimator is given by:

$$DDM = E[Score_{1,t} - Score_{1,t'} | Mig = 1, Z] - E[Score_{0,t} - Score_{0,t'} | Mig = 0, Z] \quad (5)$$

Like the DD estimator, the DDM estimator focuses on the before-after change in school performance, which is $Score_{1,t} - Score_{1,t'}$ for the treatment group and $Score_{0,t} - Score_{0,t'}$ for the control group. Because of this, the DDM estimator removes time invariant unobservable differences, a clear advantage over cross-sectional matching. Smith and Todd (2005) found that DDM performed better than DD or PSM methods since DDM eliminates potential sources of temporally invariant bias present in the data.

When implementing DDM, we use both PSM matching and bias corrected matching. In PSM, we match using the log odds-ratios. In both PSM and bias corrected matching, the nearest neighbor matching methods with replacement is used. In addition, we also compute the “adjusted” version where observations in the control group are weighted by the number of times they are matched to an observation in the treatment group.

Results of Multivariate Analysis

The DD analyses perform fairly well. In Table 2 we report the full set of results of the analysis on the Any Parent Migrated households. The results in Table 2 (and throughout the rest of the analyses) show that, although estimates of the treatment effect, the coefficient on the Any Parent Migrated dummy variable, are largely the same across all four specifications, the Unrestricted and Adjusted specification generated a much higher goodness of fit statistic (or R-squared) than other specifications, in part reflecting the importance of capturing beginning scores, which embodies the unobserved ability of a student, and other covariates. Therefore, in the rest of the analyses, when reporting the results, we will mostly focus on the results from the Unrestricted and Adjusted model. The DD analyses produced estimates with expected signs and

significance. For example, the scores of older students drop relatively more than those of younger students (row 4, column 4). This finding is reasonable since students that enter primary school at an older age may have an initial advantage because they are relatively more mature (Fredriksson and Öckert, 2005), but the initial advantage gradually disappears as younger children catch up over the course of primary school. We also find when a student's mother has a higher level of education, the student's scores improve relatively more over time. While few papers in the literature have examined the impact of the mother's education on the *change* of grades, there is a large, related literature that shows the strong positive correlation between a mother's education and the school performance of her children (e.g., Duncan, et al., 1998).

The most important finding in Table 2 is that we reject the hypothesis that migration negatively affects school performance. In all four models, the coefficient on the Any Parent Migrated household dummy variable is *not* negative (row 1). In fact, the coefficients are all positive and significantly different from zero. The magnitudes of the coefficients range from 1.16 to 3.18, meaning that, everything else held constant, after any parent in a household outmigrated between the first and fifth grade, the scores of the children of the migrants actually rose relative to the children of Never Migrant households. In other words, unlike claims made by some researchers, migration did not hurt school performance. At least in the migrant households in our sample area, migration has improved school performance.

The results hold when we examine other types of migrant households: no negative effect of migration on school performance is found. In Table 3 we only report the coefficients on the treatment variable. The rest of the results are suppressed for brevity but are available from the authors upon request. We report the results for 24 different regressions. For each of the four specifications, we look at the effect of migration on school performance in all six types of

migrant households.¹¹ In 20 out of the 24 cases the coefficient is positive. The coefficients are only negative for Mother Migrated Only households (row 4) and Mother Migrated (Unconditional) households (row 5) when the Restricted and Adjusted (column 3) or Unrestricted and Adjusted specification (column 4) is used. In each of these four cases, however, the t statistic is smaller than 0.50, indicating there is no statistically significant effect of migration on school performance. Interestingly, as in the case of Any Parent Migrated households (row 1), when the father outmigrates (row 2-3), the scores of migrant children improve.

Our results also remain largely unchanged when we use an alternative measure of the outcome variable. Following Hanushek and Rivkin (2006), we repeated the analyses in Tables 2 and 3 by using *standardized scores* in replacement of raw scores. Although standardized tests are the same for all students within a township, they differ across different townships. The standardized scores are created by subtracting the average test score of all students in the township from the tests score for each student and then dividing each score by the standard deviation of the test scores of all students in the township. After transforming raw scores to standardized scores, we can minimize differences in the grade distributions across sample schools. With this transformation, the standardized test score is interpreted as the number of standard deviations from the mean score of all students in the same grade in the same township. The results generated by using standardized test scores, like those using raw scores, show that there is no statistically significant negative effect of migration on school performance of the children (Appendix Table 2 and 3). Furthermore, the results also show that the scores of the migrant children improve after the father migrates or any of their parents migrates but do not decline when either the mother or both parents outmigrate.

It also is possible that there is an independent effect of having one or both grandparents

live with the family. To account for this, we have added a variable, Grandparent Presence, which is a dummy variable that equals one if at least one grandparent resides in the household and zero otherwise. As seen in Appendix Tables 4, when we add this variable by itself (column 1 and 2) or when we interact it with our migration variables (column 3 and 4), it is in all cases insignificant and there is no change to the results of interest.

Two more sets of analyses are carried out as robustness check. First, it is possible that the birth order of a child could affect their educational performance. In order to control for the fact that the child that we are analyzing has either older or younger siblings, we added a variable controlling for birth order. The inclusion of this variable, however, did not affect our results of interest. To show this, we added this dummy variable to our original specification and report the results in Appendix Table 5. Second, it is also possible that our decision to exclude return migrants might have affected our results. In order to test this, we reran the regressions including return migrants with our definitions of migrants (Appendix Table 6). In both sets of analyses, our results remain almost unchanged.

So why is it that migration does not appear to have a negative effect on the scores of migrant children, and in some cases even appears to have a positive effect? Although we cannot answer this question from our analyses, one possible reason is that the income effect is relatively large compared to the adverse effect of less parental supervision. If migration leads to higher income, as found in Du et al. (2005), the migrant households that experience rising incomes may be able to provide better nutrition, improved access to educational supplies and burden their children with less housework. This may have a positive effect on school performance. The positive income effect is probably behind our finding that the largest positive effects are found in the Father Migrated Only households (Table 3, row 2). This result may arise since not only

would children in such households benefit from higher incomes from migration, they would also suffer relatively less from falling parental care since the mother is still at home. Such an interpretation is also consistent with other findings. For example, Kandel and Kao (2001) found a positive relationship between fathers' migration and students' grades.

Matching Results

The results of cross-sectional matching analysis, regardless of the method of matching, also reveal that migration has no significant negative effect on the school performance of students. When Propensity Score Matching is used to examine the effect of migration on school performance for all six types of New Migrant households, there are no cases in which the coefficient on the treatment variable is negative and statistically significant (Table 4, column 1, rows 1a, 2a, 3a, 4a, 5a and 6a). The same is true when Bias Corrected Matching is used (column 1, rows 1b, 2b, 3b, 4b, 5b and 6b). In fact, results from matching are quite similar to those from the DD analyses. When we use Bias Corrected Matching, which perhaps generate better estimates and standard errors, we find that the coefficients on the treatment variables in the Father Migrated Only household model and Father Migrated (Unconditional) household model are positive and statistically significant and the magnitudes are similar to those from the DD analyses.

Finally, the findings remain largely the same when the Difference in Difference Matching estimator is used. Regardless if we use Propensity Score Matching (Table 4, column 2, rows 1a, 2a, 3a, 4a, 5a and 6a) or Bias Corrected Matching (column 2, rows 1b, 2b, 3b, 4b, 5b and 6b), none of the coefficients on the treatment variables are negative and statistically significant. When Bias Corrected Matching is used, the effects are positive and significant for the Any Parent Migrated, Father Migrated Only and Father Migrated (Unconditional) households.

Hence, whether DD, PSM or DDM is used, there is no evidence that migration in our sample households has hurt school performance. In fact, we find that when the father outmigrates (either by himself or with the mother), migration appears to have a positive effect on the school performance of migrant children.

Heterogeneous effects

So far our analyses have been focusing on different types of households according to their migration status. While we have found no significant negative impact of migration on the school performance of migrant children, all of these results have been for the *average household* for each type of migrant households. Although on average there is no effect, there could be a negative effect on a certain group of households within a type of migrant households that differ from the average households on some aspects. In this subsection we examine whether or not migration affects the following households: a.) households that are more or less wealthy; or b.) households that have an “only child” or more than one child. To do so, we add an interaction term in the specifications of the DD estimation in Table 2 and 3. For brevity, we only report the results of the Unrestricted and Adjusted specification.

The results from DD analyses did not find any significant heterogeneous effects of migration on students from households with different levels of wealth. In Table 5, we define a Poor dummy variable, which equals one if the house of a household was worth less than 5,000 yuan and zero otherwise. The coefficient on the interaction term between the Poor dummy variable and the migration dummy variable captures the heterogeneous effects of migration. The coefficient on the interaction term is insignificant for five out of six types of migrant households except for Any Parent Migrated households (rows 2 to 6). This means that there are no significant differences in the effects of migration between less and more wealthy households in

these five types of migrant households. Furthermore, since the coefficient on the migration variable is not negative for any of the five types of migrant households, there is no detectable negative effect for any type of households when we look at wealth categories. In the case of Any Parent Migrated households, although the coefficient on the interaction term is negative and significant (-2.27—column 1, row 2), the coefficient on the Any Parent Migrated variable is positive and significant and the magnitude is slightly larger (2.40—column 1, row 1). Since the net impact of migration on less wealthy households is captured by the sum of coefficients on the Any Parent Migrated variable and the interaction term, we cannot reject the hypothesis that the net impact equals zero. In short, there is no negative effect of migration on the children's school performance in either less or more wealthy households.

Similar to the results from Table 5, the results from DD analyses that examine the heterogeneity effects on the grades of children from households with one child and households with more than one child reveal that there is no significant heterogeneous effect (Table 6). The No-sibling dummy variable equals one for households with one child and zero otherwise. The coefficient on the interaction term between the No-sibling dummy variable and the migration variable is insignificant (rows 1 to 6). Although children with older siblings may have significantly higher test scores than their peers (Brown and Park, 2002), when it comes to the heterogeneous effect of migration on households with different demographic composition, there is no statistically significant effect.

Conclusions

In this paper we have tried to understand whether or not the school performance of children suffer when their father, mother or both parents migrate from the village into the city.

Despite the perception that is commonly found in the literature and the press, our results, somewhat surprisingly, show that there is no effect of migration on the school performance of the children from migrant households. Comparing the change in the grades before and after parents outmigrate between children from migrant households and those from non-migrant households, we can reject the hypothesis that migration harms the grades of migrant children. In fact, in the analysis of some migrant households, especially in those in which the father outmigrates, migration is shown to have a statistically significant and positive effect on the performance of migrant children. We also find that the effects of migration on children's school performance are not systematically different for households that are more or less wealthy households. Neither are the effects different across households that have one or more than one child.

Based on these results, it might be tempting to conclude that policy makers do not need to take any actions since there is no measurable effect of migration on school performance. If there were, education officials might want to reduce class sizes or hire more qualified teachers to improve the mentoring program in schools in which there were many children of migrants. Boarding schools might offer some of the services that parents originally carried out before they entered the migrant labor force. Ultimately, measures can be promoted to offer the children of migrants who lived in China's cities better access to urban schools so parents would not have to leave their children behind. However, all of these programs are costly. Although there might be good reason to implement such policies anyhow, according to our results, they should not be carried out on the ground of the negative effect of migration on school performance.

Although we have tried a number of alternative approaches to identify the effect of migration, and although the findings are largely robust, some of the assumptions underlying our methodologies may not be valid and that our estimates could be subject to bias. Even though we

control for many observed and time invariant unobserved factors, there still may be factors that are known by the parents of migrants and potential migrants but not be observable to the econometrician. For example, it may be that all parents who were in the village with their children in 2002 worry about whether or not their migration decision would negatively affect the school performance of their children. If it is the case that those parents who—though having an opportunity to migrate—believed that the grades of their children would suffer decided not to migrate, while those that believed their children’s grades would not suffer decided to migrate, then our results would be subject to selection bias. The effect of migration would not only be picking up the migration effect.¹²

If there was, in fact, such a selection bias and we did not account for it (as we were unable to—due to the absence of any effective instrumental variable), would our results be useless? We believe not. We believe even if there was a selection bias our results are showing that when rural parents outmigrate, the grades of their children do not suffer. It is true that part of the reason for the zero effect may be exactly this selection effect—parents do not go when they believe the grades of the children would suffer. But, from society’s point of view, there is less cost in terms of school performance of its children due to migration.

However, if one believed that the selection effect was materially important (which would mean that there is a cost to migration after all), it might call into question the policy implications discussed above. Specifically, it could mean that this is not a matter for the state to address directly. Extensive investments may be needed to improve the mentoring and increase the attention that children of migrants receive in schools. Why? Because without the intervention of the government, it is the parents and the family of the migrant children that are paying the cost. If the selection effect is large, it could be that the parent is forgoing a chance to outmigrate and

forgoing the higher income and other benefits that come from migration. It is possible that if schools were restructured in rural areas so that they were more attentive to the needs of the children of migrants or in urban areas so that they were more welcoming, migration would rise and overall both the families—and society as a whole—would benefit.

There is also another potential source of endogeneity that we are not able to account for in the analysis. It is possible that unaccounted for shocks, either in the local economy or in individual households, affect both parents' migration activities and students' grades. If these shocks systematically affect all the households, then it is possible that our coefficients also are biased due to the fact that we did not account for this type of unobservable heterogeneity. In this case, it is difficult to determine the direction of the bias. These shocks could be either negative (e.g., the family suffers a crop failure or family sickness) or positive (e.g., the family receives an inheritance or enjoys a bumper crop) and can lead to negative or positive bias in our estimates. For example, Hanson and Woodruff (2004) note that negative labor market shocks experienced by parents may both induce migration and require children to work instead of spending time in school, leading to a spurious negative relationship between migration and years of schooling. This contributes to a negative bias in the estimates of migration on education. If this is the case, then it is better to interpret our results as correlations between migration and school performance of children, but not causal effects.

References

- Abadie, A., and G. W. Imbens. 2006. "Large Sample Properties of Matching Estimators for Average Treatment Effects." *Econometrica* 74 (1): 235-267.
- Abadie, A., and G. W. Imbens. 2002. "Simple and Bias-Corrected Matching Estimators." Technical report, Department of Economics, UC Berkeley.
- Battistella, G., and M. C. G. Conaco. 1998. "The Impact of Labour Migration on the Children Left Behind: A Study of Elementary School Children in the Philippines." *Journal of Social Issues in Southeast Asia* 13 (2): 220-241.
- Benjamin, D., L. Brandt, and J. Giles. 2005. "The Evolution of Income Inequality in Rural China." *Economic Development and Cultural Change* 53 (4): 769-824.
- Blau, D. M. 1999. "The Effect of Income on Child Development." *Review of Economics and Statistics* 81 (2): 261-276.
- Brown, P. H., and A. Park. 2002. "Education and poverty in rural China." *Economics of Education Review* 21 (6): 523-541.
- Caliendo, M., and S. Kopeinig. 2008. "Some practical guidance for the implementation of propensity score matching." *Journal Of Economic Surveys* 22 (1): 31-72.
- Cox Edwards, A., and M. Ureta. 2003. "International migration, remittances, and schooling: evidence from El Salvador." *Journal of Development Economics* 72 (2): 429-461.
- de Brauw, A., and J. Giles. 2007. "Migrant Labor Markets and the Welfare of Rural Households in the Developing World: Evidence from China." Working paper, Michigan State University.
- de Brauw, A., J. Huang, S. Rozelle, L. Zhang, and Y. Zhang. 2002. "The Evolution of China's Rural Labor Markets During the Reforms." *Journal of Comparative Economics* 30 (2): 329-353.
- Dehejia, R. H., and S. Wahba. 1999. "Causal Effects in Nonexperimental Studies: Reevaluating the Evaluation of Training Programs." *Journal of the American Statistical Association* 94 (448): 1053-1062.
- Dehejia, R. H., and S. Wahba. 2002. "Propensity Score-Matching Methods for Nonexperimental Causal Studies." *Review of Economics and Statistics* 84 (1): 151-161.
- Du, Y., A. Park, and S. Wang. 2005. "Migration and rural poverty in China." *Journal of Comparative Economics* 33 (4): 688-709.
- Duncan, G. J., J. Brooks-Gunn, and P. K. Klebanov. 1994. "Economic Deprivation and Early Childhood Development." *Child Development* 65 (2): 296-318.
- Duncan, G. J., W. J. Yeung, J. Brooks-Gunn, and J. R. Smith. 1998. "How Much Does Childhood Poverty Affect the Life Chances of Children?" *American Sociological Review* 63 (3): 406-423.
- Fredriksson, P., and B. Öckert. 2005. "Is Early Learning Really More Productive? The Effect of School Starting Age on School and Labor Market Performance." IZA Discussion Papers, 1659, Institute for the Study of Labor.
- Giles, J. 2006. "Is life more risky in the open? Household risk-coping and the opening of China's labor markets." *Journal of Development Economics* 81 (1): 25-60.
- Glewwe, P., and H. G. Jacoby. 2004. "Economic growth and the demand for education: is there a wealth effect?" *Journal of Development Economics* 74 (1): 33-51.
- Hanson, G. H., and C. Woodruff. 2004. "Emigration and Educational Attainment in Mexico." Working Paper, University of California, San Diego.

- Hanushek, E. A. 1992. "The Trade-off between Child Quantity and Quality." *The Journal of Political Economy* 100 (1): 84-117.
- Hanushek, E. A., and S. G. Rivkin. 2006. "School Quality and the Black-White Achievement Gap." National Bureau of Economic Research, Inc NBER Working Papers No. 12651.
- Heckman, J. J. 2005. "China's human capital investment." *China Economic Review* 16 (1): 50-70.
- Heckman, J. J., H. Ichimura, and P. E. Todd. 1997. "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme." *The Review of Economic Studies* 64 (4): 605-654.
- Kandel, W., and G. Kao. 2001. "The Impact of Temporary Labor Migration on Mexican Children's Educational Aspirations and Performance." *International Migration Review* 35 (4): 1205-1231.
- Korenman, S., J. E. Miller, and J. E. Sjaastad. 1995. "Long-term poverty and child development in the United States: Results from the NLSY." *Children and Youth Services Review* 17 (1-2): 127-155.
- Li, X. 2004. "The Investigation on the Rural Migrant Children (in Chinese)." *Journal of Women Study in China* 10.
- Lopez-Cordova, E. 2005. "Globalization, Migration, and Development: The Role of Mexican Migrant Remittances." *Economia* 6 (1): 217-248.
- McKenzie, D., and H. Rapoport. 2006. "Can migration reduce educational attainment ? Evidence from Mexico." The World Bank Policy Research Working Paper Series No. 3952.
- McKenzie, D., and H. Rapoport. 2007. "Network effects and the dynamics of migration and inequality: Theory and evidence from Mexico." *Journal of Development Economics* 84 (1): 1-24.
- Nuttall, E. V., R. L. Nuttall, D. Polit, and J. B. Hunter. 1976. "The Effects of Family Size, Birth Order, Sibling Separation and Crowding on the Academic Achievement of Boys and Girls." *American Educational Research Journal* 13 (3): 217-223.
- Princiotta, D., K. D. Flanagan, and E. G. Hausken. 2006. "Fifth Grade: Findings from the Fifth Grade Follow-up of the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99." National Center for Education Statistics No. 2006-038.
- Rosenbaum, P. R. 2002. *Observational Studies*. New York: Springer.
- Rosenbaum, P. R., and D. B. Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects." *Biometrika* 70 (1): 41-55.
- Rozelle, S., L. Guo, M. Shen, A. Hughart, and J. Giles. 1999. "Leaving China's Farms: Survey Results of New Paths and Remaining Hurdles to Rural Migration." *The China Quarterly* (158): 367-393.
- Shaw, J. 2005 "Overseas Migration in the Household Economies of Microfinance Clients: Evidence from Sri Lanka Vol. 1 Global View." In J. Shaw, ed. *Remittances, Microfinance and Development: Building the Links Vol. 1 Global View*. Brisbane, Australia: The Foundation for Development Cooperation.
- Smith, J., and P. Todd. 2005. "Does matching overcome LaLonde's critique of nonexperimental estimators?" *Journal of Econometrics* 125 (1-2): 305-353.
- Steelman, L. C., and J. A. Mercy. 1980. "Unconfounding the Confluence Model: A Test of Sibship Size and Birth-Order Effects on Intelligence." *American Sociological Review* 45 (4): 571-582.
- Tan, S., and X. Wang. 2004. "The Study on the Migrant Children (in Chinese)." *Journal of Education in Hubei* 20.

- Todaro, M. P. 1989. *Economic Development in the Third World*. New York: Longman.
- Wang, Y., and X. Wu. 2003. "A Case Study of the Migrant Children (in Chinese)." *Investigation of the Youth* 4.
- Wolfe, J. R. 1982. "The Impact of Family Resources on Childhood IQ." *The Journal of Human Resources* 17 (2): 213-235.
- Wu, N. 2004. "The Problems on the Rural Migrant Children (in Chinese)." Unpublished Manuscript, China National Institute for Education Research.
- Yang, D. 2005. "International migration, human capital, and entrepreneurship: evidence from Philippine migrants' exchange rate shocks." The World Bank Policy Research Working Paper Series No. 3578.
- Ye, J., Y. Wang, K. Zhang, and J. Lu. 2006. "The Effect of Emigration on Children's Education Performance (in Chinese)." *Rural Economy* 7.
- Zhou, Q., and H. Wu. 2004. "A Mother of 13 Years Old." *XinhuaNet*, May 26.

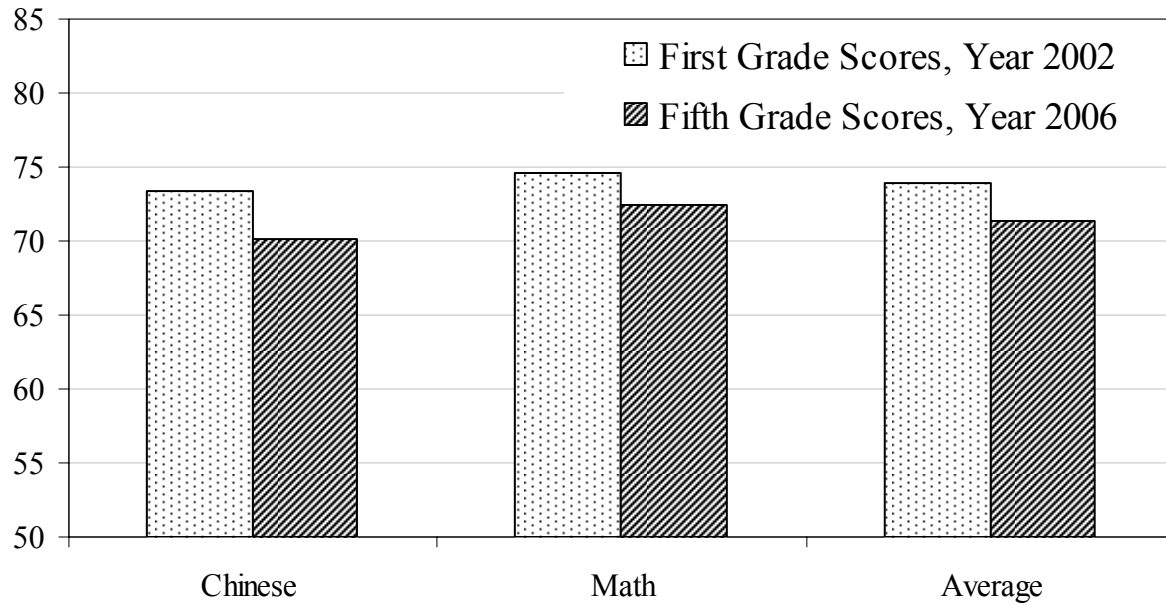


Figure 1. Average Test Scores in 2002 and 2006, Shaanxi Province, China

Data source: Authors' survey.

Note: Scores are averages of students from all types of households (migrant and non-migrant households). The Chinese, Math and Average scores are respectively standardized test scores from Chinese class, Math class and the average of Chinese and Math of students in 2002 (first grade scores) and 2006 (fifth grade scores).

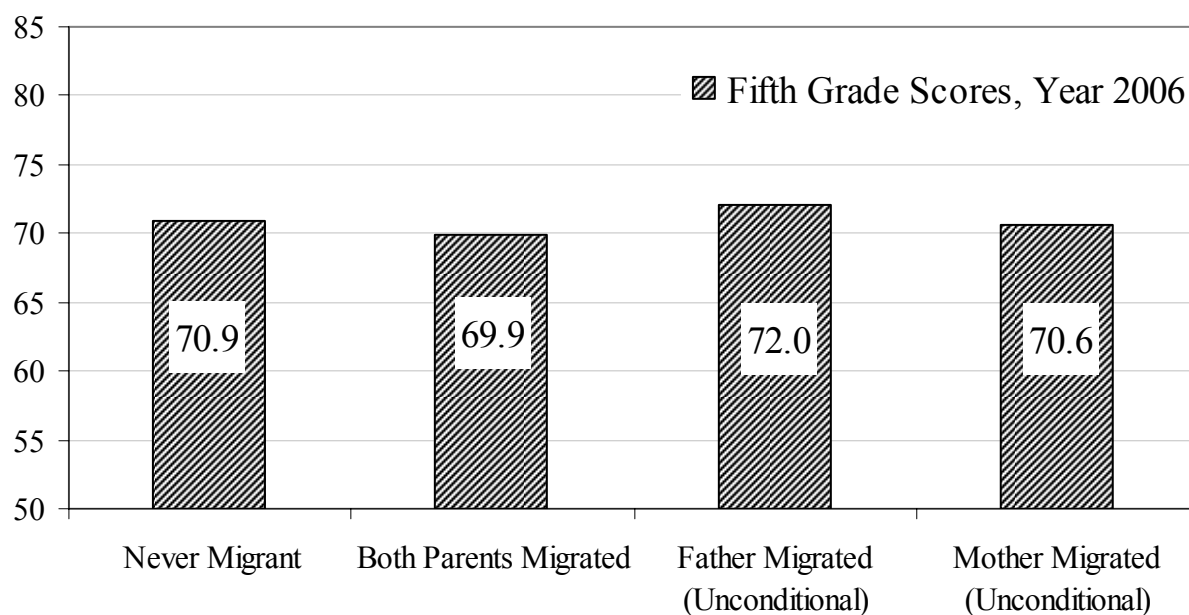


Figure 2. Fifth Grade Test Scores of Students from Migrant and Non-migrant Households in 2006, Shaanxi Province, China

Data source: Authors' survey.

Notes:

Never Migrant households: both parents stayed at home in both 2002 and 2006.

Both Parents Migrated households: both parents were at home in 2002, but both parents outmigrated by 2006

Father Migrated (Unconditional) households: the father was at home in 2002 but outmigrated by 2006 (including households in which the mother was either at home or outmigrated by 2006).

Mother Migrated (Unconditional) households: the mother was at home in 2002 but outmigrated by 2006 (including households in which the father was either at home or outmigrated by 2006).

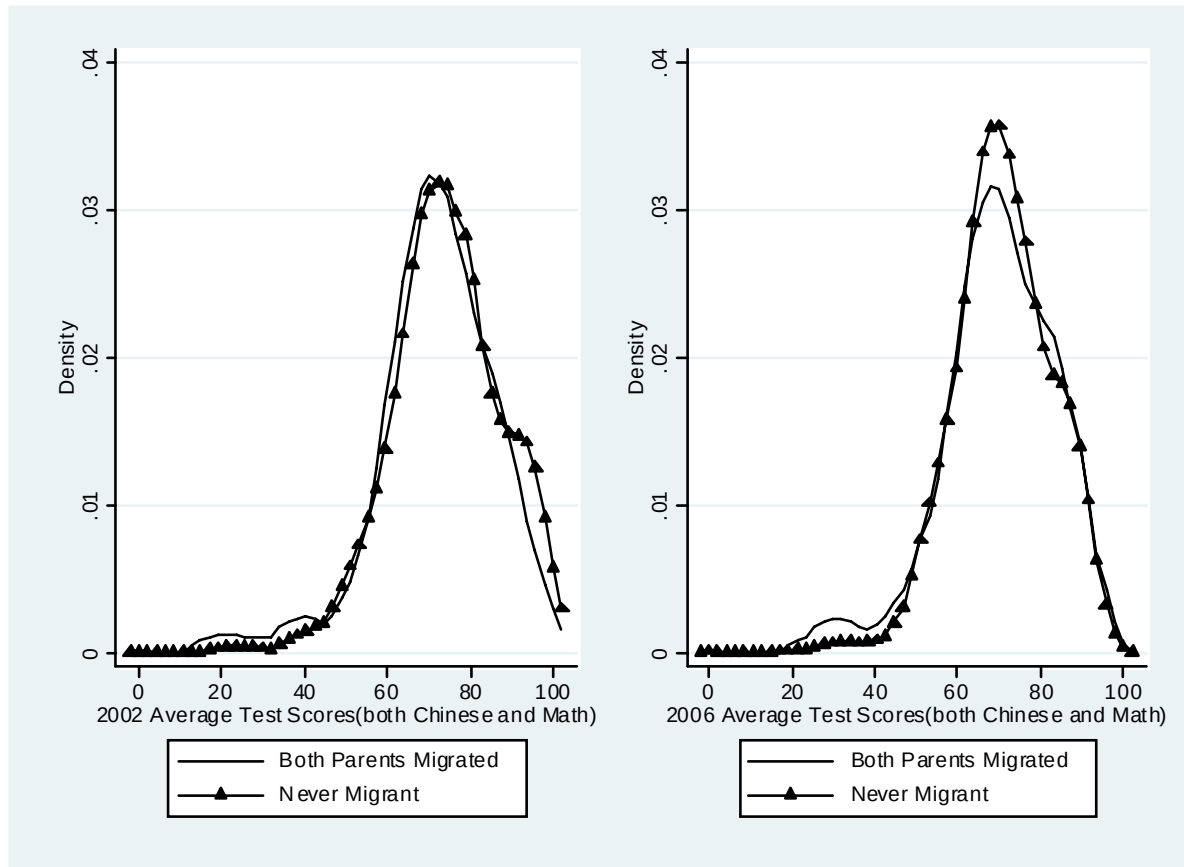


Figure 3. Distribution of Average Test Scores in Never Migrant Households and in Both Parents Migrated Households in 2002 and 2006 using Kernel Density, Shaanxi Province, China.

Data source: Authors' survey.

Note: See Figure 2 for the definition of Never Migrant and Both Parents Migrated.

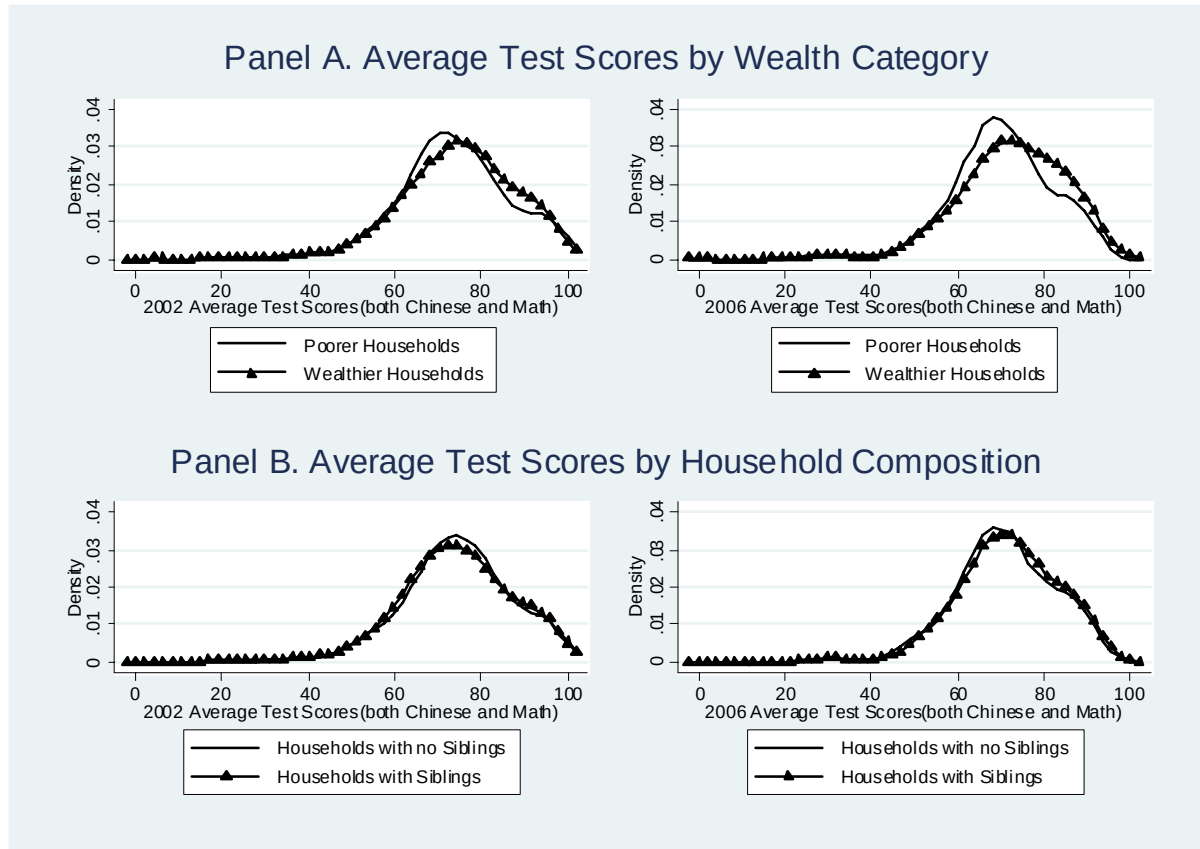


Figure 4. Distribution of Average Test Scores in Households that Vary by Wealth Category and Household Composition in 2002 and 2006 using Kernel Density, Shaanxi Province, China.

Data source: Authors' survey.

Note: *Poorer Households* are those whose house was worth less than 5,000 yuan; *Wealthier Households* are those whose house was worth more than 5,000. *Households with no Siblings* are those in which the student is an only child; *Households with Siblings* are those in which the student has at least one brother or sister.

Table 1. Patterns of Migration in Sample Households in 2002 and 2006, Shaanxi Province, China.

Migration Status in 2002		Migration status in 2006			
	(1) Number of Households in 2002 ^a	(2) <i>Father Migrated Only (mother stayed home)</i>	(3) <i>Mother Migrated Only (father stayed home)</i>	(4) <i>Both Parents Migrated</i>	(5) <i>Return migrants (rows 1-3) ^b Never Migrant (row 4)</i>
(1) <i>Only Father Migrated</i>	149	94 ^c			55
(2) <i>Only Mother Migrated</i>	18		9 ^c		9
(3) <i>Both Parents Migrated</i>	69	7	5	40 ^c	17
(4) <i>Neither Parent Migrated</i>	1,358	131 ^d	35 ^d	54 ^d	1,138
(5) Total number of households	1,594	232	49	94	1,219

Data source: Authors' survey.

^a Column (1) = Column (2) + Column (3) + Column (4) + Column (5).

^b The households in column 5, rows 1, 2 and 3 are return migrants (or those households in which households had a migrant in 2002 and by 2006 had returned home. These households are dropped from the multivariate analysis.

^c The diagonal elements in the first three rows of the 2006 matrix (row 1, column 2; row 2, column 3; row 3, column 4) are *Always Migrant* households. These households are dropped from the multivariate analysis.

^d Total new migrants (or those households in which the parents did not migrate in 2002 and migrated by 2006) is found in row 4 by summing columns 2, 3 and 4).

Table 2. Evaluating the Effects of Migration Activities of Parents on School Performance of Students in Any Parent Migrated households using Difference-in-Difference, Shaanxi Province, China.^a

	Treatment Variable (MIG_i) ^b	Outcome Variable ($\Delta Score_i$) = $Score_{i, 2006} - Score_{i, 2002}$			
		(1) Restricted & Unadjusted	(2) Unrestricted & Unadjusted	(3) Restricted & Adjusted ^c	(4) Unrestricted & Adjusted ^c
(1)	<i>Any_Parent_Migrated</i>	3.183 (3.72)***	2.327 (3.03)***	2.169 (2.58)**	1.164 (1.65)*
Characteristics of the students in 2002					
(2)	Student score in the second term in 2002 (Full score is 100)		-0.460 (14.93)***		-0.627 (18.04)***
(3)	Gender dummy (=1 if male and 0 if female)			0.826 (1.28)	-0.383 (0.75)
(4)	Age of the student in 2002 (Years)			0.097 (0.26)	-1.322 (4.39)***
(5)	Cadre dummy (=1 if the student was a student cadre in 2002 and 0 if not)			-2.754 (3.83)***	1.168 (1.93)*
(6)	Mentor dummy (=1 if the student had a mentor in 2002)			-1.051 (0.99)	-0.972 (1.26)
(7)	Sibling dummy (=1 if the student had no siblings in 2002)			0.438 (0.55)	0.443 (0.71)
Characteristics of the parents in 2002					
(8)	Age of the father (Years)			-0.066 (0.85)	-0.053 (0.85)
(9)	Level of education of the father (Years of schooling)			-0.200 (1.06)	-0.044 (0.35)
(10)	Level of education of the mother (Years of schooling)			0.114 (0.77)	0.274 (2.39)**
Characteristics of the household in 2002					
(11)	Size of total household land holding in 2002 (mu)			0.031 (0.36)	0.037 (0.57)
(12)	Number of household members in 2002 (Person)			0.078 (0.25)	0.251 (1.01)
(13)	House value dummy (=1 if the house is worth more than 5,000 yuan)			0.056 (0.08)	-0.037 (0.07)
(14)	Number of observations	1575	1575	1549	1549
(15)	R-squared	0.01	0.27	0.10	0.43

Data source: Authors' survey.

^a Four versions of specifications are used in the difference-in-difference estimation. An unrestricted model includes $Score_{i, 2002}$ as a right hand side variable. This removes the restriction in the standard DD model that the coefficient on $Score_{i, 2002}$ equals one. An adjusted model includes other covariates in addition to the treatment variable.

Model (1) is the standard DD model and is restricted and unadjusted. Mathematically, model (1) is expressed as $\Delta Score_i = \alpha + \delta MIG_i + \varepsilon_i$, where i is the index for students; $\Delta Score_i$ is the before-after change in the school performance of student i , that is, scores from the fifth grade minus scores from the first grade; MIG_i is the treatment variable and δ is the parameter of interest, which measures the treatment effect.

Model (2) is unrestricted and unadjusted, which is expressed as $\Delta Score_i = \alpha + \delta MIG_i + \gamma Score_{i, 2002} + \varepsilon_i$. Model (3) is restricted and adjusted. Model (3) is expressed as $\Delta Score_i = \alpha + \delta MIG_i + \mathbf{X}_i \boldsymbol{\beta} + \varepsilon_i$, where $\mathbf{X}_i$ is a vector of covariates that include the characteristics of students, parents and households, and a set of township dummy variables. Model (4) is unrestricted and adjusted and is expressed as $\Delta Score_i = \alpha + \delta MIG_i + \gamma Score_{i, 2002} + \mathbf{X}_i \boldsymbol{\beta} + \varepsilon_i$.

^b The treatment variable MIG_i is *Any_Parent_Migrated*, a dummy variable that is equal to 1 if both parents lived at home in 2002 and at least one parent (either the father; mother or both parents) outmigrated by 2006.

^c The coefficients on the township dummy variables are Not reported here for the sake of brevity.

^d Robust t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3. Evaluating the Effects of Migration Activities of Parents on School Performance of Students in All Six Types of Migrant households using Difference-in-Difference, Shaanxi Province, China.^a

Treatment Variable (MIG _i) ^b	Outcome Variable ($\Delta Score_i$) = $Score_{i, 2006} - Score_{i, 2002}$			
	(1) Restricted & Unadjusted	(2) Unrestricted & Unadjusted	(3) Restricted & Adjusted ^c	(4) Unrestricted & Adjusted ^c
(1) <i>Any_Parent_migrated</i> ,	3.183	2.327	2.169	1.164
	(3.72)***	(3.03)***	(2.58)**	(1.65)*
No. of observations	1575	1575	1549	1549
R-squared	0.01	0.27	0.10	0.43
(2) <i>Father_Migrated_Only</i> (<i>mother stayed home</i>)	4.634	3.812	3.630	2.356
	(4.27)***	(4.09)***	(3.45)***	(2.73)***
No. of observations	1577	1577	1549	1549
R-squared	0.01	0.28	0.10	0.43
(3) <i>Father_Migrated</i> (<i>Unconditional</i>)	3.812	2.879	2.984	1.508
	(4.10)***	(3.52)***	(3.24)***	(1.98)**
No. of observations	1595	1595	1551	1551
R-squared	0.01	0.27	0.10	0.43
(4) <i>Mother_Migrated_Only</i> (<i>father stayed home</i>)	0.839	0.156	-0.861	-0.121
	(0.45)	(0.08)	(0.45)	(0.07)
No. of observations	1576	1576	1549	1549
R-squared	0.00	0.27	0.09	0.43
(5) <i>Mother_Migrated</i> , (<i>Unconditional</i>)	0.903	0.444	-0.147	-0.541
	(0.73)	(0.37)	(0.12)	(0.48)
No. of observations	1587	1587	1551	1551
R-squared	0.00	0.27	0.09	0.43
(6) <i>Both_parents_migrated</i> ,	1.367	0.615	1.040	-0.536
	(0.79)	(0.38)	(0.58)	(0.35)
No. of observations	1575	1575	1549	1549
R-squared	0.00	0.27	0.09	0.43

Data source: Authors' survey.

^a See note a in Table 2 for explanations of the specifications of model (1) to (4).

^b The treatment variable MIG_i takes the following six forms:.

Any_Parent_Migrated, which is a dummy variable that is equal to 1 if both parents lived at home in 2002 and at least one parent (either the father; mother or both parents) outmigrated by 2006.

Father_Migrated_Only(mother stayed at home) is a dummy variable that is equal to 1 if only the father outmigrated by 2006 but was at home in 2002;

Father_Migrated (Unconditional) is a dummy variable that is equal to 1 if the father was at home in 2002 but outmigrated by 2006 (including households in which the mother was either at home or not at home in 2006);

Mother_Migrated_Only(Father stayed at home) is a dummy variable that is equal to 1 if only the mother outmigrated by 2006 but was at home in 2002;

Mother_Migrated (Unconditional) is a dummy variable that is equal to 1 if the mother was at home in 2002 but outmigrated by 2006 (including households in which the father was either at home or not at home in 2006);

Both_Parents_Migrated is a dummy variable =1 if both parents were at home in 2002, but outmigrated by 2006;

^c The coefficients on the township dummy variables are not reported here for the sake of brevity.

^d Robust *t* statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Evaluating the Effects of Migration Activities of Parents on School Performance of Students in All Six Types of Migrant households using Matching and Difference-in-Difference Matching, Shaanxi Province, China ^a.

Treatment Variable ^c		Matching ^a		Difference-in-Difference Matching	
		Average Treatment Effect for the Treated	t-stat/ z-value ^b	Average Treatment Effect for the Treated	t stat/ z-value ^b
<i>Any_parent_migrated</i>	(1a) Propensity Score Matching	1.16	(1.02)	0.31	(0.28)
	(1b) Bias Corrected Matching	1.57	(1.60)	2.12	(1.86)*
<i>Father_Migrated_Only</i> (<i>mother stayed home</i>)	(2a) Propensity Score Matching	2.04	(1.36)	1.12	(0.77)
	(2b) Bias Corrected Matching	3.59	(2.96)***	3.12	(1.93)**
<i>Father_migrated,</i> (<i>Unconditional</i>)	(3a) Propensity Score Matching	1.57	(1.20)	2.35	(1.93)**
	(3b) Bias Corrected Matching	2.19	(2.04)***	2.52	(1.99)***
<i>Mother_Migrated_Only</i> (<i>father stayed home</i>)	(4a) Propensity Score Matching	-0.63	(-0.22)	-1.1	(-0.39)
	(4b) Bias Corrected Matching	-0.94	(-0.43)	1.93	(0.58)
<i>Mother_migrated</i> (<i>Unconditional</i>)	(5a) Propensity Score Matching	-0.45	(-0.26)	-1.51	(-0.88)
	(5b) Bias Corrected Matching	-0.46	(-0.32)	0.82	(0.48)
<i>Both_parents_migrated</i>	(6a) Propensity Score Matching	-0.22	(-0.09)	-0.56	(-0.23)
	(6b) Bias Corrected Matching	-0.28	(-0.13)	0.97	(0.43)

Data source: Authors' survey.

^a Propensity scores are estimated using the same set of covariates as in Table 2.

^b *t* statistics are reported for propensity score matching and z-values are reported for bias corrected matching in parentheses. * denotes significant at 10% level, ** denotes significant at 5% level, ***denotes significant at 1% level.

^c The treatment variables are described in note b in Table 3.

Table 5. Evaluating the Heterogeneous Effects of Migration Activities of Parents on School Performance of Students in Migrant households with different Wealth using Difference-in-Difference, Shaanxi Province, China.

Treatment Variable (MIG_i) ^a	Outcome Variable ($\Delta Score_i$) $= Score_{i,2006} - Score_{i,2002}$
(1) <i>Any_Parent_Migrated</i>	2.397
	(2.82)***
<i>Any_Parent_Migrated*Poor</i>	-2.271
	(1.79)*
(2) <i>Father_Migrated_Only</i> (mother stayed home)	2.958
	(2.83)***
<i>Father_Migrated_Only*Poor</i>	-1.170
	(0.72)
(3) <i>Father_Migrated</i> (Unconditional)	2.668
	(2.85)***
<i>Father_Migrated * Poor</i>	-2.139
	(1.54)
(4) <i>Mother_Migrated_Only</i> (Father stayed home)	2.285
	(1.59)
<i>Mother_Migrated_Only* Poor</i>	-3.783
	(1.28)
(5) <i>Mother_Migrated</i> (Unconditional)	1.349
	(0.99)
<i>Mother_Migrated * Poor</i>	-3.369
	(1.62)
(6) <i>Both_Parents_Migrated</i>	1.720
	(0.87)
<i>Both_Parents_Migrated * Poor</i>	-3.982
	(1.38)

Data source: Authors' survey.

^a The regression model used in Panel A is $\Delta Score_i = \alpha + \delta_1 MIG_i + \delta_2 MIG_i * Poor_i + \gamma Score_{i,2002} + \mathbf{X}_i \boldsymbol{\beta} + \varepsilon_i$, where i is the index for students, MIG_i is the treatment variable and it takes six forms (see note b in Table 3 for the definitions of the six forms). The poor dummy equals to 1 if the housing value was worth more than 5,000 in 2002 and 0 otherwise. $Score_{i,2002}$ is the score of student i in 2002. Only the estimates of δ_1 and δ_2 are reported. Covariates, $\mathbf{X}_i$, are the same as those in Table 2.

^c Robust t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Evaluating the Heterogeneous Effects of Migration Activities of Parents on School Performance of Students in Migrant households with different Household Composition using Difference-in-Difference, Shaanxi Province, China.

Treatment Variable (MIG_i) ^a		Outcome Variable ($\Delta Score_i$) $= Score_{i,2006} - Score_{i,2002}$
(1)	<i>Any_Parent_Migrated</i>	1.118 (1.28)
	<i>Any_Parent_Migrated*Nosibling</i>	0.195 (0.15)
(2)	<i>Father_Migrated_Only</i> (mother stayed home)	2.028 (1.87)*
	<i>Father_Migrated_Only*Nosibling</i>	0.965 (0.57)
(3)	<i>Father_Migrated</i> (Unconditional)	1.516 (1.60)
	<i>Father_Migrated * Nosibling</i>	0.028 (0.02)
(4)	<i>Mother_Migrated_Only</i> (Father stayed home)	-0.828 (0.40)
	<i>Mother_Migrated_Only* Nosibling</i>	1.680 (0.48)
(5)	<i>Mother_Migrated</i> (Unconditional)	-0.403 (0.29)
	<i>Mother_Migrated * Nosibling</i>	-0.174 (0.08)
(6)	<i>Both_Parents_Migrated</i>	0.155 (0.08)
	<i>Both_Parents_Migrated* Nosibling</i>	-1.457 (0.48)

Data source: Authors' survey.

^a The regression model used in Panel B is $\Delta Score_i = \alpha + \delta_1 MIG_i + \delta_2 * MIG_i * Nosibling + \gamma Score_{i,2002} + \mathbf{X}_i \beta + \varepsilon_i$, where i is the index for the student, MIG_i is the treatment variable and it takes six forms (see Table 3 for the definitions of the six forms), $Nosibling$ is the sibling dummy in 2002 which equals to 1 if the student had no siblings in 2002 and 0 otherwise, $Score_{i,2002}$ is the score of student i in 2002. Only the estimates of δ_1 and δ_2 are reported. Covariates, $\mathbf{X}_i$, are the same as those in Table 2 except that here we exclude a sibling dummy variable.

^b Robust t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 1. Summary Statistics of Variables Used in the Multivariate Analysis in 2002.

Control Variables		Never Migrant		Any Parent Migrated		Total	
Characteristics of the students							
(1)	Gender dummy(=1 if male and 0 if female)	0.56	(0.50)	0.58	(0.50)	0.55	(0.50)
(2)	Age of students when they were in the first grade	7.86	(0.96)	7.92	(0.92)	7.87	(0.96)
(3)	Cadre dummy (=1 if the student was a student cadre and 0 if not)	0.34	(0.47)	0.30	(0.46)	0.33	(0.47)
(4)	Mentor dummy (=1 if the student had a mentor and 0 otherwise)	0.87	(0.34)	0.87	(0.33)	0.86	(0.35)
(5)	Sibling dummy (=1 if the student had no siblings and 0 otherwise)	0.29	(0.46)	0.38	(0.49)	0.33	(0.47)
Characteristics of the parents							
(6)	Age of the father (Years)	34.74	(4.31)	34.60	(4.30)	34.62	(4.28)
(7)	Education of the father (Years of schooling)	7.80	(2.32)	8.03	(2.73)	7.84	(2.47)
(8)	Education of the mother (Years of schooling)	7.19	(2.66)	7.17	(2.91)	7.15	(2.81)
Characteristics of the household							
(9)	Size of total household land holding (mu)	6.45	(5.01)	5.77	(5.51)	6.17	(5.26)
(10)	Number of household members (Person)	4.58	(1.14)	4.40	(1.20)	4.53	(1.16)
(11)	House value dummy (=1 if the house value is worth more than 5,000 yuan)	0.50	(0.50)	0.56	(0.50)	0.52	(0.50)

Data source: Authors' survey

Notes: Mean values are reported in the table with standard deviation in the parenthesis.

Never Migrant is a household in which both parents stayed at home in both 2002 and 2006.

Any Parent Migrated is a household in which both parents stayed at home in 2002 and at least one parent (either the father; mother or both parents) outmigrated by 2006.

Appendix Table 2. Evaluating the Effects of Migration Activities of Parents on School Performance of Students (measured by Standardized Scores) in All Six Types of Migrant households using Difference-in-Difference, Shaanxi Province, China.^a

		Outcome Variable ($\Delta Score\ Std_i$) = $Score\ Std_{i,2006} - Score\ Std_{i,2002}$			
Treatment Variable (MIG_i) ^b		(1)	(2)	(3)	(4)
		Restricted & Unadjusted	Unrestricted & Unadjusted	Restricted & Adjusted ^c	Unrestricted & Adjusted ^c
(1)	<i>Any_Parent_migrated,</i>	0.148 (2.19)**	0.086 (1.39)	0.157 (2.27)**	0.083 (1.40)
	No. of observations	1575	1575	1549	1549
	R-squared	0.00	0.24	0.02	0.33
(2)	<i>Father_Migrated_Only</i> <i>(mother stayed home)</i>	0.254 (2.98)***	0.194 (2.53)**	0.270 (3.14)***	0.175 (2.39)**
	No. of observations	1577	1577	1549	1549
	R-squared	0.01	0.24	0.02	0.33
(3)	<i>Father_Migrated</i> <i>(Unconditional)</i>	0.211 (2.84)***	0.144 (2.13)**	0.220 (2.90)***	0.111 (1.72)*
	No. of observations	1595	1595	1551	1551
	R-squared	0.01	0.24	0.02	0.33
(4)	<i>Mother_Migrated_Only</i> <i>(father stayed home)</i>	-0.011 (0.07)	-0.060 (0.38)	-0.075 (0.47)	-0.020 (0.13)
	No. of observations	1576	1576	1549	1549
	R-squared	0.00	0.24	0.02	0.33
(5)	<i>Mother_Migrated,</i> <i>(Unconditional)</i>	0.008 (0.08)	-0.025 (0.26)	-0.017 (0.16)	-0.047 (0.50)
	No. of observations	1587	1587	1551	1551
	R-squared	0.00	0.24	0.02	0.33
(6)	<i>Both_parents_migrated,</i>	0.083 (0.58)	0.028 (0.21)	0.076 (0.51)	-0.041 (0.32)
	No. of observations	1575	1575	1549	1549
	R-squared	0.00	0.24	0.02	0.33

Data source: Authors' survey.

^a See note a in Table 2 for explanations of the specifications of model (1) to (4).

^b The treatment variable MIG_i takes the following six forms. See note b in Table 3 for the definitions.

^c Robust t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 3. Evaluating the Effects of Migration Activities of Parents on School Performance of Students (measured by Standardized Scores) in All Six Types of Migrant households using Difference-in-Difference and Adjusting for Clustering Effects, Shaanxi Province, China.^a

Treatment Variable (MIG_i) ^b	Outcome Variable ($\Delta Score\ Std_i$) = $Score\ Std_{i,2006} - Score\ Std_{i,2002}$			
	(1) Restricted & Unadjusted	(2) Unrestricted & Unadjusted	(3) Restricted & Adjusted ^c	(4) Unrestricted & Adjusted ^c
(1) <i>Any_Parent_migrated</i> ,	0.148 (3.49)***	0.086 (2.31)**	0.157 (3.41)***	0.083 (2.81)**
No. of observations	1575	1575	1549	1549
R-squared	0.00	0.24	0.02	0.33
(2) <i>Father_Migrated_Only</i> (<i>mother stayed home</i>)	0.254 (2.50)**	0.194 (1.97)*	0.270 (2.80)**	0.175 (2.22)**
No. of observations	1577	1577	1549	1549
R-squared	0.01	0.24	0.02	0.33
(3) <i>Father_Migrated</i> (<i>Unconditional</i>)	0.211 (3.93)***	0.144 (2.89)**	0.220 (4.00)***	0.111 (3.84)***
No. of observations	1595	1595	1551	1551
R-squared	0.01	0.24	0.02	0.33
(4) <i>Mother_Migrated_Only</i> (<i>father stayed home</i>)	-0.011 (0.06)	-0.060 (0.44)	-0.075 (0.45)	-0.020 (0.14)
No. of observations	1576	1576	1549	1549
R-squared	0.00	0.24	0.02	0.33
(5) <i>Mother_Migrated</i> , (<i>Unconditional</i>)	0.008 (0.07)	-0.025 (0.33)	-0.017 (0.15)	-0.047 (0.60)
No. of observations	1587	1587	1551	1551
R-squared	0.00	0.24	0.02	0.33
(6) <i>Both_parents_migrated</i> ,	0.083 (0.54)	0.028 (0.24)	0.076 (0.50)	-0.041 (0.35)
No. of observations	1575	1575	1549	1549
R-squared	0.00	0.24	0.02	0.33

Data source: Authors' survey.

^a See note a in Table 2 for explanations of the specifications of model (1) to (4).

^b The treatment variable MIG_i takes the following six forms. See note b in Table 3 for the definitions.

^c Robust t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 4. Evaluating the Effects of Migration Activities of Parents on School Performance of Students in Any Parent Migrated households using Difference-in-Difference and Controlling for the Presence of Grandparent(s), Shaanxi Province, China.

		Outcome Variable ($\Delta Score_i = Score_{i, 2006} - Score_{i, 2002}$)			
		(1)	(2)	(3)	(4)
		Restricted & Adjusted ^c	Unrestricted & Adjusted ^c	Restricted & Adjusted ^c	Unrestricted & Adjusted ^c
Treatment Variable (MIG_i)^b					
(1)	<i>Any_Parent_Migrated</i>	2.133 (2.53)**	1.140 (1.61)	2.348 (2.26)**	1.003 (1.11)
(2)	Grandparent Presence Dummy (=1 if grandparents were in the household in 2002)	-0.510 (0.72)	0.029 (0.05)		
(3)	<i>Any_Parent_Migrated</i> *Grandparent Presence Dummy ^a			-0.522 (0.32)	0.369 (0.28)
Characteristics of the students in 2002					
(4)	Student score in the second term in 2002 (Full score is 100)		-0.630 (18.14)***		-0.630 (18.09)***
(5)	Gender dummy (=1 if male and 0 if female)	0.826 (1.27)	-0.423 (0.83)	0.796 (1.23)	-0.423 (0.83)
(6)	Age of the student in 2002 (Years)	0.110 (0.30)	-1.306 (4.32)***	0.113 (0.30)	-1.306 (4.32)***
(7)	Cadre dummy (=1 if the student was a student cadre in 2002 and 0 if not)	-2.801 (3.89)***	1.152 (1.90)*	-2.805 (3.88)***	1.159 (1.91)*
(8)	Mentor dummy (=1 if the student had a mentor in 2002)	-1.085 (1.01)	-0.994 (1.29)	-1.083 (1.01)	-0.997 (1.29)
(9)	Sibling dummy (=1 if the student had no siblings in 2002)	0.555 (0.70)	0.375 (0.59)	0.438 (0.55)	0.371 (0.59)
Characteristics of the parents in 2002					
(10)	Age of the father (Years)	-0.079 (0.99)	-0.059 (0.93)	-0.071 (0.90)	-0.059 (0.94)
(11)	Level of education of the father (Years of schooling)	-0.194 (1.03)	-0.022 (0.18)	-0.194 (1.02)	-0.023 (0.18)
(12)	Level of education of the mother (Years of schooling)	0.121 (0.81)	0.278 (2.41)**	0.120 (0.80)	0.278 (2.42)**
Characteristics of the household in 2002					
(13)	Size of total household land holding in 2002 (mu)	0.028 (0.33)	0.032 (0.49)	0.030 (0.35)	0.032 (0.49)
(14)	Number of household members in 2002 (Person)	0.184 (0.54)	0.223 (0.79)	0.085 (0.27)	0.219 (0.88)
(15)	House value dummy (=1 if the house is worth more than 5,000 yuan)	0.078 (0.11)	0.004 (0.01)	0.062 (0.09)	0.002 (0.00)
(17)	Number of observations	1541	1541	1541	1541
(18)	R-squared	0.10	0.43	0.10	0.43

Data source: Authors' survey.

^a See note a in Table 2 for explanations of the specifications of model (1a) to (2b).

^b The treatment variable MIG_i is *Any_Parent_Migrated*, a dummy variable that is equal to 1 if both parents lived at home in 2002 and at least one parent (either the father; mother or both parents) outmigrated by 2006.

^c The coefficients on the township dummy variables are not reported here for the sake of brevity.

^d Robust *t* statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 5. Evaluating the Effects of Migration Activities of Parents on School Performance of Students in Any Parent Migrated households using Difference-in-Difference and Controlling for Younger Sibling instead of No Sibling, Shaanxi Province, China.^a

	Outcome Variable ($\Delta Score_i$) = $Score_{i, 2006} - Score_{i, 2002}$			
	(1)	(2)	(3)	(4)
	Restricted & Unadjusted	Unrestricted & Unadjusted	Restricted & Adjusted ^c	Unrestricted & Adjusted ^c
Treatment Variable (MIG_i)^b				
(1) <i>Any_Parent_Migrated</i>	3.183 (3.72)***	2.327 (3.03)***	2.208 (2.63)***	1.189 (1.69)*
Characteristics of the students in 2002				
(2) Student score in the second term in 2002 (Full score is 100)		-0.460 (14.93)***		-0.627 (18.12)***
(3) Gender dummy (=1 if male and 0 if female)			0.867 (1.39)	-0.313 (0.62)
(4) Age of the student in 2002 (Years)			0.083 (0.23)	-1.339 (4.48)***
(5) Cadre dummy (=1 if the student was a student cadre in 2002 and 0 if not)			-2.742 (3.83)***	1.180 (1.96)*
(6) Mentor dummy (=1 if the student had a mentor in 2002)			-1.065 (1.00)	-0.983 (1.28)
(7) Younger sibling dummy (=1 if the student had any younger siblings)			0.220 (0.28)	-0.158 (0.26)
Characteristics of the parents in 2002				
(8) Age of the father (Years)			-0.091 (1.06)	-0.058 (0.85)
(9) Level of education of the father (Years of schooling)			-0.200 (1.07)	-0.044 (0.35)
(10) Level of education of the mother (Years of schooling)			0.112 (0.75)	0.274 (2.39)**
Characteristics of the household in 2002				
(11) Size of total household land holding in 2002 (mu)			0.028 (0.33)	0.036 (0.56)
(12) Number of household members in 2002 (Person)			-0.011 (0.04)	0.198 (0.83)
(13) House value dummy (=1 if the house is worth more than 5,000 yuan)			0.060 (0.09)	-0.029 (0.05)
(14) Number of observations	1575	1575	1549	1549
(15) R-squared	0.01	0.27	0.10	0.43

Data source: Authors' survey.

^a See note a in Table 2 for explanations of the specifications of model (1) to (4).

^b The treatment variable MIG_i is *Any_Parent_Migrated*, a dummy variable that is equal to 1 if both parents lived at home in 2002 and at least one parent (either the father, mother or both parents) outmigrated by 2006.

^c The coefficients on the township dummy variables are not reported here for the sake of brevity.

^d Robust *t statistics* in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 6. Evaluating the Effects of Migration Activities of Parents on School Performance of Students in Any Parent Migrated households using Difference-in-Difference and Controlling for Return Migrants, Shaanxi Province, China.^a

	Outcome Variable ($\Delta Score_i$) = $Score_{i, 2006} - Score_{i, 2002}$			
	(1)	(2)	(3)	(4)
	Restricted & Unadjusted	Unrestricted & Unadjusted	Restricted & Adjusted ^c	Unrestricted & Adjusted ^c
Treatment Variable (MIG_i)^b				
(1) <i>Any_Parent_Migrated</i>	3.334 (3.91)***	2.443 (3.20)***	2.320 (2.73)***	1.229 (1.74)*
(2) <i>Any_Parent_Return</i> ^d	2.526 (1.37)	1.916 (1.42)	2.190 (1.22)	0.923 (0.82)
Characteristics of the students in 2002				
(3) Student score in the second term in 2002 (Full score is 100)		-0.460 (15.21)***		-0.626 (18.32)***
(4) Gender dummy (=1 if male and 0 if female)			0.852 (1.31)	-0.370 (0.72)
(5) Age of the student in 2002 (Years)			0.083 (0.23)	-1.326 (4.39)***
(6) Cadre dummy (=1 if the student was a student cadre in 2002 and 0 if not)			-2.785 (3.94)***	1.149 (1.93)*
(7) Mentor dummy (=1 if the student had a mentor in 2002)			-0.987 (0.95)	-0.945 (1.24)
(8) Sibling dummy (=1 if the student had no siblings in 2002)			0.366 (0.45)	0.413 (0.65)
Characteristics of the parents in 2002				
(9) Age of the father (Years)			-0.060 (0.78)	-0.050 (0.81)
(10) Level of education of the father (Years of schooling)			-0.193 (1.05)	-0.041 (0.33)
(11) Level of education of the mother (Years of schooling)			0.111 (0.76)	0.272 (2.39)**
Characteristics of the household in 2002				
(12) Size of total household land holding in 2002 (mu)			0.038 (0.45)	0.040 (0.62)
(13) Number of household members in 2002 (Person)			0.070 (0.23)	0.247 (1.00)
(14) House value dummy (=1 if the house is worth more than 5,000 yuan)			0.062 (0.09)	-0.034 (0.06)
(15) Number of observations	1575	1575	1548	1548
(16) R-squared	0.01	0.27	0.10	0.44

Data source: Authors' survey.

^a See note a in Table 2 for explanations of the specifications of model (1) to (4).

^b The treatment variable MIG_i is *Any_Parent_Migrated*, a dummy variable that is equal to 1 if both parents lived at home in 2002 and at least one parent (either the father; mother or both parents) outmigrated by 2006.

^c The coefficients on the township dummy variables are Not reported here for the sake of brevity.

^d The dummy variable, *Any_Parent_Return*, equals 1 if any parent returned home in 2006 while he/she outmigrated in 2002 and equals to 0 if he/she stayed at home during 2002 and 2006..

^e Robust *t statistics* in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Endnotes

¹ Although the ages of children ranged from 6 to 16, only few children in the sample were older than 14. Specifically, there were eight children that were 15 years old and one that was 16 years old. We have controlled for these outliers in our analysis by including a variable measuring the age of the student. Part of the reason that they are so old could be that they repeated one or more grades. Furthermore, one important reason that they repeated grades might be there was so much disruption when their parents outmigrated. To control for those students that repeated at least one grade during their primary schools years, we have added a grade repetition dummy in the specifications in Table 2 and 3 in a set of analyses (results available upon request). The scores of students that have repeated one or more grades drop more quickly. The rest of the results, however, were almost unchanged.

² It is possible that if the dropping out behavior, even though not so prevalent, was in some sense associated with the decision of the family to outmigrate, then ignoring these cases could influence our results. In fact, we find no evidence that dropping out is associated with migration. In tracing the 19 students that dropped out, in more than 15 cases, the child dropped out for health reasons. In a series of follow up interviews, we were told by the principals of the sample schools that drop outs almost never had anything to do with either grades or migration. Hence, there is no reason to believe that our results suffer from a bias due to the fact that we ignore drop outs. When also we ran a regression explaining the number of dropouts that a school had experienced as a function of a number of the school's characteristics and the coefficient on the variable measuring the number of migrants was insignificant. deBrauw and Giles (2007) consider why it is important (for estimating the coefficients which measure the impact of migration on educational attainment of high school students) to account for the impact of the reduction in the cost of migration (through the reduction of barriers to migration). While important in their context, this is not relevant in our case since there is such a low drop out rate and since there is little reason to believe that dropping out is associated with the migration decision.

³ In the case of the students that were retained, we recorded the grades of the first grade year, which unless the child had only been retained for first grade year, was prior to the 2001/2002 academic year.

⁴ There are several issues to discuss when considering our measure of income. The value of the house only includes the part of the house used for domicile purposes and the value of assets that were used for farming and nonfarm businesses was not included. Yuan is the Chinese currency. One dollar was about 7.6 yuan during the time of our survey. Finally, we admit that we only have a rough proxy for income. Because of this it is possible that we will not be able to identify the impact of income on grades (since the coefficient of the variable could be biased down to zero). The cross sectional variation for income (using our measure), however, does show that there is at least a negative correlation (richer households have children with higher grades). In fact, there are reasons to expect a positive effect of income on grades. The literature (e.g., Kandel and Kao, 2001) has shown that the positive relationship between the father's migration and the school performance partly stems from the financial resources provided migration, which lowers the likelihood of children's labor force participation and increases resources for consumption of education-related goods.

⁵ Since the migration activities of the parents of these children took place before the period of study, these households are not included in the analyses.

⁶ The term, wealth, when used in the rest of the paper will refer to the value of housing assets only.

⁷ However, it should also be remembered if the increase in wealth is due to the fact that one or more household members (including the father and mother) out migrate, a child that is left behind may also be responsible for more household chores, and so have less time to study. The direction of the net effect is an empirical question.

⁸ Graphs of distributions of propensity scores that show the common support are available upon request.

⁹ This is achieved by using the STATA command "nnmatch."

¹⁰ This is accomplished by assigning an arbitrarily high weight to the exact matching variable in defining the matching criteria.

¹¹ For completeness in Table 3, we include the results of the effect of Any Parent Migrated on school performance, but, in fact, this is a duplication of the results from Table 2, row 1.

¹² It is important to note that according to theory, PSM and DDM are designed to account for at least part of the unobserved heterogeneity that might be causing any selection bias, so, in fact, it can be argued that we have addressed this concern. Moreover, although we raise this issue because it theoretically is possible, in fact, in practice there is reason to believe it is not that serious of a statistical problem. We believe this because this is only a problem parents will only choose NOT to migrate if the cost of lower grades is higher than the benefits of migrations. We do not believe this is true, in general. The cost of lower grades FOR PARENTS is going to show only in the future—in our case 5 to 10 years later when these children enter the job market. The benefits of migration, on the other hand, accrue to the family immediately. Taking into account that the discount rate for individuals in developing countries is generally quite high, is reasonable to say that lower grades will not stop most parents from migrating.