



DEMOGRAPHIC RESEARCH

A peer-reviewed, open-access journal of population sciences

DEMOGRAPHIC RESEARCH

VOLUME 29, ARTICLE 2, PAGES 33-70

PUBLISHED 4 JULY 2013

<http://www.demographic-research.org/Volumes/Vol29/2/>

DOI: 10.4054/DemRes.2013.29.2

Research Article

Does migration benefit the schooling of children left behind? Evidence from rural northwest China

Feng Hu

© 2013 *Feng Hu*.

This open-access work is published under the terms of the Creative Commons Attribution NonCommercial License 2.0 Germany, which permits use, reproduction & distribution in any medium for non-commercial purposes, provided the original author(s) and source are given credit. See <http://creativecommons.org/licenses/by-nc/2.0/de/>

Table of Contents

1	Introduction	34
2	Data	39
3	Possible channels of migration effects: Descriptive evidence	43
4	Empirical methodology	47
5	Estimation results	51
5.1	OLS results	51
5.2	Instrumental variables method	53
6	Extensions	56
6.1	Effects differentiated by the gender of children	56
6.2	Parents' migration instead of migration of household members	58
7	Conclusions	60
8	Acknowledgements	61
	References	62
	Appendix	68

Does migration benefit the schooling of children left behind? Evidence from rural northwest China

Feng Hu¹

Abstract

BACKGROUND

While many studies have found that migration can benefit home communities and family members left behind by increasing household income, thus easing liquidity constraints on investment; less is known about how “internal” migration and remittances affect the educational performance of the children who are left behind in the source communities.

OBJECTIVE

My aim in this paper is to examine the effects of migration on the educational attainment of left-behind rural children in northwest China. To gain a better understanding of whether the educational performance of these children improves or suffers when adult family members migrate, I attempt to disentangle the effects of remittances from the effects of migration.

METHODS

The data used in this study come from the 2004 wave of the Gansu Survey of Children and Families. To account for the possible endogeneity of migration-related variables, I use the migration network variables to instrument for different migration strategies.

RESULTS

The results show that the absence of adult household members, including parents, has a negative effect on the educational performance of the children left behind, but that remittances can partially compensate for this loss. Boys’ educational performance does not seem to be greatly affected by the migration of adult household members. By contrast, the absence of adult household members is shown to have a large negative effect on girls’ educational performance, and the positive effect of remittances is also found to be significant for girls.

CONCLUSIONS

The findings may be of interest to other developing countries with large internal migration flows and to the relevant policy makers, as the results suggest that

¹ Dongling School of Economics and Management, University of Science and Technology Beijing.
Email: feng3hu@gmail.com.

remittances sent home by out-migrants may serve as a channel for investing in human capital in the migrants' regions of origin, and especially for investing in the human capital of girls.

1. Introduction

In recent years, researchers and policy makers have become increasingly interested in the effects of migration and remittances on the development of communities of origin in developing countries (de Brauw and Rozelle 2008; Démurger and Xu 2011; Mendola 2008; Taylor and Lopez-Feldman 2010; Woodruff and Zenteno 2007; Yang 2008). While a number of studies have shown that migration can benefit home communities and left-behind family members by increasing household income, thus lifting liquidity constraints on investment, less is known about how migration and remittances affect the educational performance of the children who remain in the source communities. Furthermore, the existing studies on this topic have mostly focused on the effects of “international” migration and remittances (such as Alcaraz, Chiquiar, and Salcedo 2012; Amuedo-Dorantes and Pozo 2010; Antman 2012; Arguillas and Williams 2010; Calero, Bedi, and Sparrow 2009; Edwards and Ureta 2003; Hanson and Woodruff 2003; McKenzie and Rapoport 2011), while relatively few studies² have examined the impact of “internal” migration and remittances on the education of the migrant's children who remain in the home region, even though internal rural-urban migration has become a major social and economic phenomenon in many developing countries.³

The migration of adult household members can affect the education of the children who are left behind in several ways. First, the absence of adult household members, and especially of parents, can lead to a lack of supervision, the development of psychological problems, or the need to take on extra work in the household for left-behind children. These kinds of problems may have negative effects on the education of the children in these households (Amuedo-Dorantes, Georges, and Pozo 2010; Hanson

² The exceptions may be Berker (2009) on Turkey, Kuhn (2006) on Bangladesh, Mueller and Shariff (2011) on India, and several papers on China mentioned below.

³ The possible effects of internal migration may differ from those of international migration, at least in the following two respects. First, international migrants are usually less likely to visit the families they left behind during the migration period, possibly due to the much higher traveling costs. In contrast, domestic migrants may return home frequently due to the lower traveling costs, and may even stay home for several months a year. Therefore, the negative effects on children's education due to parental absence may be smaller in the case of domestic migration. On the other hand, international migrants can usually earn higher incomes and send a larger amount of money home (Adams Jr. and Cuecuecha 2010). Therefore, the positive effects associated with the receipt of remittances may be larger for international migration than for domestic migration.

and Woodruff 2003; McKenzie and Rapoport 2011). Second, the migration experience of adult household members can provide job-related information and lower the migration costs of left-behind children through network effects. Having a parent in another region may facilitate the migration of left-behind children, which could have a negative impact on their education, since the opportunity costs of staying at school would be rather high, especially for children in poor households (de Brauw and Giles 2008; McKenzie and Rapoport 2011).⁴ Third, the migration of household members may bring outside information into the home which is helpful for the children's education. Similarly, exposure to the outside world could lead migrants to learn more about the importance of investing in education, and about how best to educate the children in their own household (Lee and Park 2010). Finally, the remittances sent home could have a positive effect on children's education, since this financial transfer can help to ease household liquidity constraints and allow the family to invest more in their children's education (Alcaraz, Chiquiar, and Salcedo 2012; Amuedo-Dorantes, Georges, and Pozo 2010; Calero, Bedi, and Sparrow 2009; Edwards and Ureta 2003; Hanson and Woodruff 2003; Taylor and Lopez-Feldman 2010). In sum, the effects of the absence of adult household members on children's education may be ambiguous, depending on the relative magnitudes of the various relevant channels; while the effects of remittances seem to be positive. Therefore, studies that only focus on the effects of either the absence or the remittances will generally deliver biased estimates (Lu 2012; McKenzie and Rapoport 2011). To better answer the question of whether children's schooling benefits from the migration of their parents, it is desirable to model the two effects separately, since only a portion of migrants send remittances home. However, because most household surveys do not provide information regarding both the migration of household members and their remittance patterns, few studies to date have provided empirical evidence on both of these effects.⁵

Since China currently has what may be the largest internal flow of people from rural to urban areas in the world, it is important to examine to what extent the children who remain behind in rural China have benefited or suffered from this unprecedented migration trend.⁶ However, while rural people in China have gained more freedom in recent years to move circularly between cities and their home regions, many institutional barriers (e.g., discriminatory regulations and rules regarding employment,

⁴ For example, Atkin (2012) found that school dropout rates increase with local expansions of export manufacturing in Mexico due to the rising opportunity cost of staying in school.

⁵ Recent papers, including those by Amuedo-Dorantes and Pozo (2010); Amuedo-Dorantes, Georges, and Pozo (2010); Bansak and Chezum (2009); Bredl (2011); and Hu (2012) are among the few studies which have attempted to disentangle the effects of remittance from the effects of migration on children's education.

⁶ With the relaxation of restrictions on rural-urban migration since China's reform and opening up in the late 1970s, the number of rural-urban migrants had reached 159 million by the end of 2011, or almost three-quarters of the total of 215 million international migrants around the world (National Bureau of Statistics of China 2012; The World Bank 2011).

housing, and children's education) continue to prevent rural migrants from permanently settling in cities (Chan and Buckingham 2008; Hu, Xu, and Chen 2011).⁷ Therefore, rural migrants usually have to travel on their own to seek job opportunities in cities, leaving their children at home (Brown 2006; Chen et al. 2009).⁸ According to an authoritative survey report by All-China Women Federation (Jia and Tian 2010), the estimated number of left-behind children in rural areas reached nearly 58 million in 2008, a figure that represents almost 30% of all rural children in China.

This phenomenon of left-behind children in rural areas has recently attracted considerable attention from scholars and government officials in China. While some studies (such as Xiang 2007; Duan and Zhou 2005; Kong and Meng 2010; Ye et al. 2006) have provided descriptive or anecdotal evidence on this topic, only a few recent econometric studies (Chen et al. 2009; Lee 2011; Lee and Park 2010; Lu 2012; Meyerhoefer and Chen 2011) have examined the issue.⁹ Moreover, the existing empirical evidence is generally inconclusive. According to Lee (2011) and Meyerhoefer and Chen (2011), parental migration has a negative impact on children's schooling. By contrast, Chen et al. (2009) have shown that the migration of one or both parents has no statistically significant effect on the education of the children who remain at home. Meanwhile, Lee and Park (2010) found that migration by fathers has negative effects on the enrolment rates of boys, but that the educational performance of girls seems to improve. Finally, Lu (2012) studied the effects of migration by both parents and siblings on the children left at home. She found that parental migration has a negative effect on the education of left-behind children, especially of younger children; while the migration of siblings often leads to improvements in the education of the children who remain in the home region.

One possible explanation for these seemingly conflicting conclusions is that the above studies were based only on the net effect of migration, while the effects of the absence of household members and of remittances may go in opposite directions. In investigating the question of whether children's education is positively or negatively

⁷ Please see Chan and Buckingham (2008) for more details about the institutional barriers faced by China's rural migrants.

⁸ There are many reasons for why China's migrant parents leave their children behind in their home regions. As is the case in other developing countries, China's migrant parents often do not have enough time to take care of their children or enough money to support their children's education in cities. However, another possible reason is related to China's unique hukou system, which ties educational benefits to local urban hukou (Chan and Buckingham 2008; Hu, Xu, and Chen 2011). For example, migrant children without local urban hukou have to return to their home provinces to take the college entrance exam, which may have a totally different content, even if they are allowed to attend the local urban high school in the migration destination. Therefore, China's migrant parents usually leave their children behind to be educated in their home region instead of taking their children to the destination region. Thus, compared with other developing countries, China's strong institutional barriers might make migrant parents more likely to leave their children in their home regions.

⁹ For the existing studies in Chinese, please refer to the recent literature review by Tan (2011).

affected by the migration of adult household members, it is desirable to disentangle the effects of remittances from those of migration.¹⁰

My aim in this paper is to examine these two effects separately using survey data from the 2004 wave of the GSCF (Gansu Survey of Children and Families), which provides useful information on migration and remittances receipt among rural households in northwest China. Since children can be enrolled in school but perform poorly, using only the option of enrollment or the school year as the educational indicator, as was done in previous studies (for example, Hu 2012; Lee 2011; Lu 2012; Meyerhoefer and Chen 2011), may not be enough to capture how children's education has been affected by the migration of adult household members. I therefore use in this paper more direct educational indicators—i.e., standardized test scores—to assess the effects of migration and remittances on the educational performance of the children left behind.

The main empirical challenge in this paper is to identify the effects of migration on the educational performance of the children left behind, as migration and remittance decisions might be correlated with some unobservable factors which also determine the children's educational performance. For instance, compared with their non-migrant counterparts, migrants may care more about their children's education, and be more likely to devote attention or other resources to improving the educational performance of their children (McKenzie and Rapoport 2011). In addition, the simple OLS estimation may suffer from reverse causality problems. For example, liquidity-constrained households may send adult household members to cities in order to raise money for the children's education. Finally, there may be measurement errors in the self-reported remittances status, as people are often reluctant to reveal information about their income to strangers like enumerators. However, the problem of underreporting is likely to be less serious if people are simply asked whether they send or receive remittances, and not to report the amount of the remittances.

In line with the existing migration literature, I address these concerns by using the migration network variables to instrument for different migration strategies. It is widely recognized that access to migration networks can help lower the cost of moving, and may therefore facilitate the migration of others in the same household or village. In addition, migrants may be more likely to send remittances home if other migrants from the same household or village also send remittances. I control for several household-level and village-level variables as well in order to minimize concerns about the validity of the instrument variables.

¹⁰ In a similar vein, Rozelle, Taylor, and de Brauw (1999) and Taylor, Rozelle, and de Brauw (2003) have separately estimated the effects of migration and remittances on the agricultural production and incomes of left-behind households in rural areas of China.

After accounting for the endogeneity of migration-related variables, the results show that the absence of adult household members, including parents, has a negative effect on the educational performance of the children left behind, but that remittances can at least partially compensate for this loss. The education of boys seems to be largely unaffected by the migration of adult household members. By contrast, the absence of adult household members is shown to have a large negative effect on the educational performance of girls, but the positive effect of remittances is also significant for girls. However, since I use only the 2004 wave of GSFC in this paper, the above effects are based on short-term results, and should therefore be interpreted with caution. The main contributions of this paper are twofold. First, this paper adds to the limited literature concerning the effects of internal migration, rather than international migration, on the education of left-behind children. This issue is especially important in China, where there were about 159 million internal rural-urban migrants by the end of 2011 (National Bureau of Statistics of China 2012). Second, this paper is one of the few studies that attempt to distinguish the effects of remittances from the effects of migration on the education of left-behind children. This differentiation is helpful in explaining the mechanisms through which migration affects children's education.

This study also contributes to the broad body of literature on children's education in developing countries. Education has been found to play a crucial role in promoting the welfare of children, increasing their skill levels and improving their health. Moreover, this human capital can be transmitted intergenerationally (Glewwe and Kremer 2006). Having recognized the large potential benefits associated with educational investment, developing countries have greatly expanded their educational systems in recent decades.

The rest of the paper is organized as follows. The next section introduces the data source. The third section provides some descriptive evidence on possible channels through which the migration of household members affects the education of the children left behind. Section 4 outlines the empirical methodology. Section 5 presents the empirical results on the effects of different household migration strategies on children's educational performance. Section 6 differentiates the above effects by gender, and also uses parental migration instead of the migration of adult household members to show the robustness of the results. The final section concludes.

2. Data

The data used in this study come from the Gansu Survey of Children and Families (GSCF). This is a longitudinal survey examining children's welfare outcomes in rural areas of Gansu province, a less developed region located in the northwest of China.¹¹ I use the 2004 wave of the survey data in this study.¹² The selected sample, which covers 20 out of 86 counties in Gansu province, was drawn using a multi-stage approach, in which counties, townships, villages, and then children from birth registries were randomly chosen.¹³ The 2004 wave of GSCF was conducted based on a random sample of 2000 children in rural areas of Gansu province who were nine to 12 years old in 2000.¹⁴ The survey also asked related information on the siblings of sampled children. Taken together, the 2004 wave included a total of 2,888 child observations.

The GSCF collects detailed information on children's education, including current educational level, self-rated educational performance, educational expenses, and study habits. For a consistent comparison, I chose the main measures of children's education based on their performance in one academic examination administrated by the survey team, rather than their self-reported performance, since the latter is a subjective indicator which is more likely to suffer from measurement errors or omitted variable bias when used as the dependent variable.¹⁵ The interviewed children were asked to take part in academic examinations of both Chinese language and math skills appropriate for their grade levels. Primary school students were required to finish the examinations within 60 minutes, while middle and high school students were given 90 minutes. The contents of the examinations were the same for all children at the same grade level. To make the test scores comparable, I standardized the test scores by grade level to achieve a mean of zero and standard deviation of one.

¹¹ According to the National Bureau of Statistics of China (2005b), Gansu's per capita GDP in 2004 was 5,970 yuan (about \$750), placing it second-to-last among the 31 provinces of mainland China.

¹² This longitudinal survey has collected data in 2000, 2004, 2007, and 2009. The 2004 wave of the survey data is the most recent that is publically available. However, because the relevant information in the 2000 and the 2004 waves is somewhat inconsistent, in this paper I made the conservative choice to use only the 2004 wave to examine the short-term effects of migration on the children left behind in the migrants' home regions.

¹³ In total, there are 42 sample townships and 100 sample villages selected from the 20 counties. For detailed information on the survey sampling, please visit the GSCF website: <http://china.pop.upenn.edu/documentation>.

¹⁴ Only 82 children (about 4% of the total) in the 2000 wave were not re-interviewed in the 2004 wave, reflecting a low attrition rate.

¹⁵ About 12% of the 2,888 children interviewed in 2004 did not take the tests because most of them were out of school at that time. Therefore, I excluded them from the later analysis. Among the remaining sample children, 44% of them were attending primary school, 53% were in middle school, and only about 3% were in high school or technical school.

The GSCF survey also includes a household questionnaire¹⁶, which collects general information regarding household characteristics (such as the demographic characteristics of household members) and specific information on the wage employment of adult household members in the preceding year,¹⁷ including the number of working days and the job location (within the home village, outside the home village but within the home town, outside the home town but within the home county, outside the home county but within the home province, outside the home province). Based on this set of information, I defined a migrant as an individual who worked outside his or her home town for at least 180 days of the preceding year. This is in line with the definition used in the national migrant survey by National Bureau of Statistics of China (2012).¹⁸ Of the 771 migrants in the sample, about one-third worked within their home counties, while the remaining two-thirds worked in other counties or provinces.¹⁹

Another key variable is the remittances sent home by adult household members in the preceding year. Along with questions about the employment of adult household members, the household survey also asks the following question: “How much did he/she give to the family remaining in the home region in the past year?” Although this question does not directly measure the amount of remittances, it may be used as a good approximation of whether remittances had been received. For example, according to this definition, 47.47% (=366/771) of the migrants had sent remittances home in the past year.²⁰ By contrast, of the 652 non-migrants who also provided wage employment

¹⁶ A household is defined as including all individuals who had lived in the same dwelling unit and who had temporarily migrated to cities during the past year. In rural China, children, parents, and grandparents usually live in the same dwelling unit, or at least in the same village.

¹⁷ Here “the preceding year” refers to the period from June of 2003 until the time of the survey (June 2004). In addition, although the survey team had originally intended to ask about wage employment, 5% of respondents claimed that they were self-employed.

¹⁸ In the existing literature, the migrant definition varies greatly in terms of individual job location and duration. For example, Lee and Park (2010) and Rozelle, Taylor, and de Brauw (1999) define a migrant as a person who works away from home (or outside of the home county) for at least three months in the preceding year. By contrast, Chen et al. (2009) define a migrant as a person who works outside of the home village without a specific job duration.

¹⁹ Almost all of the 771 sample migrants are parents or siblings, and there are only four other adult household members in the sample.

²⁰ The proportion of remittance-receiving households seems to be relatively small compared with the figures found in the existing literature. For example, the share was 77% in Rozelle, Taylor, and de Brauw (1999). One possible explanation for our figures is that the Gansu migrants earned much less than migrants in other provinces, and thus remitted less money, or were less likely to remit. For example, according to the GSCF survey used in this paper, the average monthly income was only 555 yuan. This number is much lower than the national average of 780 yuan in 2004 (Ministry of Agriculture of PRC 2005), but it is consistent with the migrant survey conducted by Gansu Provincial Bureau of Statistics (2007). In addition, because the definition of migrant varies considerably across studies, the proportion of remittances found in this study may not be directly comparable to the shares found in other studies.

information, only about 5% of them reported that they had given money to the family in the past year.²¹

In order to separately estimate the effects of the absence of adult household members and the effects of remittances on the children's education, I then categorized rural households into different types. Based on whether adult household members migrated and whether those migrating household members sent remittances in the preceding year, rural households were divided into the following three groups: non-migrant households (households in which no adult members are migrants), migrant households without remittances (households in which there is at least one migrant, but which do not receive remittances), and migrant households with remittances (households which have at least one migrant and receive remittances).²² The proportions of these three types of households are 66.79%, 17.52%, and 15.69%, respectively.²³

Table 1 displays summary statistics of the main variables by household migration status. As we can see in the first two rows, the educational performance of children in migrant households is lower than that of their counterparts in non-migrant households. When migrant households are broken down by those that do and do not receive remittances, children from migrant households that receive remittances are, on average, shown to perform better than those from migrant households that do not receive remittances; this suggests that remittances may partially compensate for the negative effects of the absence of adult household members on children's education.

²¹ A simple comparison of the two shares of money given to the family by migrants and non-migrants suggests that the definition of remittances received based on the above question may be appropriate.

²² Because remittances are defined as only being relevant for migrant households, rural households can be categorized into the three types exclusively.

²³ Because people are usually reluctant to reveal the exact amounts of their remittances to enumerators or they may not be able to recall the exact figures, the self-reported amounts of remittances may suffer from serious measurement errors. By contrast, people may be more willing to report whether or not they have received remittances, and are more likely to be able to recall this information; thus, the yes/no response on remittances is less likely to be subject to measurement errors (Mansour, Chaaban, and Litchfield 2011). Therefore, I decided to use the likelihood of sending remittances rather than the amount of remittances in the following analysis.

Hu: Does migration benefit the schooling of children remaining behind?

Table 1: Summary statistics of main variables by migration categories

	Total	Non-migrant household	Migrant household with no remittances	Migrant household with remittances
Standardized test score				
Chinese language	0.00	0.02	-0.07	0.05
Math	0.00	0.02	-0.06	0.02
Child characteristics				
Male (%)	55.32	54.95	56.68	55.46
Age	14.12	14.01	14.27	14.46
First-born (%)	30.48	33.94	28.51	15.04
Household characteristics				
Size	4.77	4.73	4.70	5.06
Number of children	2.38	2.33	2.34	2.72
Father's education (year)	6.95	6.94	7.26	6.60
Mother's education (year)	4.26	4.29	4.59	3.71
Land (mu) ^a	9.53	9.81	8.92	8.84
Wealth level (yuan) ^b	12198	12047	12507	12624
Community characteristics				
Distance to primary school (km)	0.96	1.11	0.61	0.62
Distance to middle school (km)	3.64	3.81	3.26	3.30
Distance to the nearest road (km)	2.31	2.31	2.25	2.41
Observations	2534	1759	436	339

Note: a. 1 mu = 667 square meters. b. Household wealth level is represented by house value.

The survey also shows that non-migrant households have larger amounts of farmed land than migrant households, which suggests that the labor burden associated with agricultural activities may discourage migration to cities. This is because the labor market in rural China is still underdeveloped, and rural households have to allocate the labor resources of their members to farming activities (Yang 1997). Another interesting finding is that migrant households with more children at home are more likely to receive remittances, which may be invested in the children's education. I use the household house value to represent the household wealth level, since the house is usually the most valuable fixed asset of rural Chinese households, and is therefore

indicative of long-term economic status (de Brauw and Rozelle 2008).²⁴ In order to minimize a possible correlation between the wealth level represented by the household home value and migrant remittances, I subtract the value of a newly built house in the area in 2004 from the total household home value. The descriptive statistics show that the average wealth level does not differ considerably among the various types of households.

3. Possible channels of migration effects: Descriptive evidence

The survey provides detailed information on issues such as parental expectations for children's educational attainment, the amount of time parents spend helping their children with homework, children's participation in out-of-school tutoring, and the extent to which children are involved in household chores and income-generating activities. This information may shed some light on the possible channels of the impact of migration on the educational performance of left-behind children.

As we can see in Table 2, migrant parents seem to have higher expectations for the future educational attainment of their children. This suggests that the parents' exposure to the outside world may benefit the education of left-behind children, or that migrant parents are self-selected to be more concerned about the education of their children than their non-migrant counterparts. Migrant mothers in particular are likely to say they hope their children will at least graduate from high school, and 87% of them express the hope that their children will earn a college degree or higher. On the other hand, the absence of the parents means that they will spend less time helping their children with homework, which could have negative effects on the children's education.

Table 3 compares children's participation in out-of-school tutoring and their labor activities by different household migration strategies. The possibility of attending out-of-school tutoring is greater for children in migrant households than for those in non-migrant households. Furthermore, those children in households that receive remittances are more likely to attend after-school training than those in migrant households that receive no remittances. This suggests that the receipt of remittances represents a channel through which households may be able to invest more in their children's education.

²⁴ The average household house value measured in GSCF survey was 12,045 yuan in 2004, which is consistent with the 14,184 yuan found in the national rural household survey by the National Bureau of Statistics of China (2005a).

Hu: Does migration benefit the schooling of children remaining behind?

Table 2: Parental expectations for children’s educational attainment and tutor time

	Father		Mother	
	Migrant	Non-migrant	Migrant	Non-migrant
Expectation for children's educational attainment				
Primary school (%)	0.27	0.78	0.00	0.12
Middle school (%)	2.93	3.92	0.00	2.82
High school (%)	11.97	14.28	13.04	12.40
College and above (%)	84.83	81.02	86.96	84.66
Tutor time (hours per week)				
no time (%)	1.14	1.40	0.17	1.10
no time (%)	69.23	69.34	86.96	74.72
1-4 hours (%)	22.83	19.95	13.04	17.61
5-9 hours (%)	6.37	7.66	0.00	5.43
10 hours and above (%)	1.57	3.05	0.00	2.24
Observations	377	2186	23	2497

Note: Because some parents reported their expectations or tutor time for more than one child, the sum of observations is more than 2,000 for fathers or mothers, respectively.

When we look at children’s daily time allocation, we can see that children in migrant households are more involved in housework and income-generating activities than children in non-migrant households (Chang, Dong, and Macphail 2011). However, children from remittance-receiving migrant households are less likely to be burdened with family labor activities than their counterparts in migrant households that do not receive remittances. These findings suggest that the absence of an adult household member may increase children’s levels of involvement in household chores and income-generating activities, but that remittances may relieve their labor burdens to some extent.

Table 3: Children's out-of-school tutoring and labor activities

	Non-migrant household	Migrant household with no remittances	Migrant household with remittances
Receiving out-of-school tutoring (%)			
Chinese language	13.89	14.22	14.80
Math	11.17	11.89	12.99
Household chores (hours per week)			
Cooking	0.97	1.19	1.23
Washing	1.68	2.31	1.94
Other household chores	4.41	4.70	4.78
Total	7.05	8.21	7.95
Income generating activities (hours in the past year)			
Farming/forestry	55.58	70.74	62.65
Animal husbandry	18.60	20.60	22.11
Family private business	2.51	1.19	0.67
Total	76.69	92.52	85.43
Observations	1767	430	334

An analysis of children's out-of-school tutoring and labor activities by gender generates some interesting descriptive findings. As we can see in Table 4, girls in non-migrant household are less likely to attend out-of-school tutoring than boys, but girls in remittance-receiving households seem to benefit from the migration, as they are much more likely to attend out-of-school tutoring. When it comes to household chores, girls are found to have greater housework burdens than boys, with many of these girls doing the cooking and washing (Chang, Dong, and Macphail 2011). However, the labor burden for girls in remittance-receiving households is smaller than for girls in households that do not receive remittances. On the other hand, while boys from non-migrant households generally assume more responsibility than girls for income-generating activities, girls from migrant households that receive no remittances have to take on more income-generating activities than boys. By contrast, girls from remittance-receiving households are less likely to engage in those external activities than girls in households that do not receive remittances. The levels of engagement in income-generating activities do seem to differ not much between boys in migrant households with and without remittances.

Table 4: Children’s out-of-school tutoring and labor activities by gender

	Non-migrant		Migrant		Migrant	
	Male	Female	Male	Female	Male	Female
Receiving out-of-school tutoring (%)						
Chinese language	14.96	12.52	12.60	16.39	11.89	18.49
Math	12.84	9.03	12.60	10.93	12.43	13.70
Household chores (hours per week)						
Cooking	0.53	1.52	0.23	2.47	0.67	1.93
Washing	1.32	2.14	1.94	2.81	1.61	2.36
Other household chores	4.37	4.46	4.68	4.73	4.78	4.78
Total	6.22	8.12	6.84	10.01	7.06	9.06
Income-generating activities (hours in the past year)						
Farming/forestry	61.15	48.47	66.13	76.81	68.20	55.54
Animal husbandry	18.40	18.85	19.27	22.35	23.92	19.81
Family private business	3.96	0.66	0.66	1.89	0.22	1.25
Total	83.51	67.99	86.06	101.05	92.34	76.60
Observations	990	777	246	184	188	146

In sum, the descriptive statistics suggest that the effects of the absence of adult household members on the education of the children left behind are unclear. Children are left with greater labor burdens and less educational assistance, but they may also benefit from their parents’ exposure to urban life, because migrant parents may develop higher educational aspirations for their children. On the other hand, children seem to benefit from remittances, which ease the liquidity constraints on rural households, freeing up more money for investment in the children’s education. Furthermore, the possible advantages or disadvantages associated with the migration of adult household members differ by gender: girls are usually burdened with more household chores or income-generating activities, but they also seem to benefit more from the remittances sent home by adult household members. Thus, in order to determine whether the education of the children left behind improves as a result of the migration of adult household members, it is necessary to supplement descriptive statistics with a regression-based analysis.

4. Empirical methodology

To examine the effect of migration and remittances on educational performance of the children left behind, I start with the following linear model using the OLS technique:

$$Score_i^S = \beta_0 + \beta_1 NM_i + \beta_2 MR_i + \beta_2 X_i^E + \varepsilon_i \quad (1)$$

where the dependent variable $Score^S$ denotes children's standardized test score ($S =$ Chinese language or math). For the key explanatory migration-related variables, I use migrant households that do not receive remittances as the reference group. NM is a dummy variable representing whether the household had no migrant members in the past year, and MR is a dummy variable indicating whether the household had migrant members and received remittances in the past year. Therefore, β_1 represents the opposite of the possible effect of the absence of adult household members and β_2 indicates the possible effect of remittances.

The vector X^E includes a number of the explanatory variables thought to be important determinants of children's educational performance. The first set of explanatory variables included in the vector X^E consists of children's characteristics, such as age, gender, and whether a child is the oldest in the family. These variables were chosen because gender and birth order play important roles in children's educational performance (Amuedo-Dorantes and Pozo 2010; Arguillas and Williams 2010; Zhao and Glewwe 2010). The second set of variables is related to household characteristics. Since parental education can have a large impact on children's educational performance (Amuedo-Dorantes and Pozo 2010; Brown 2006; Edwards and Ureta 2003), both the fathers' and the mothers' schooling in years are included in the equation. Other household characteristics, such as household size, number of siblings, the amount of farmed land, and household wealth level, are also included because they represent either the household's ability to support the children's education or the possible labor burden on children.²⁵ Finally, I include in the equation several community variables, such as the distance from the village to the nearest primary school and to the nearest middle school. These variables were chosen because children's educational performance can be affected by local school infrastructure, such as school availability (Jensen and Nielsen 1997; Zhao and Glewwe 2010).²⁶ I also include the

²⁵ To avoid possible endogeneity of the household wealth variable, here I decided to use the log of household house values (subtracting the value of the average newly built house in the area in 2004) to represent the household wealth level, as in rural China the value of the household's home represents a large share of the household's long-term wealth (de Brauw and Rozelle 2008).

²⁶ Here I did not include the distance to the nearest high school because only about 3% of the children in the sample were attending high school.

distance to the nearest road, since it may be related to the amount of time it takes children to get to school.

Nevertheless, a causal interpretation of the above OLS estimates may be problematic. Since migration is a selective process, migration strategies can be correlated with some unobservable factors which also determine children's educational performance.²⁷ For instance, compared with their non-migrant counterparts, migrants may care more about their children's education, and be more likely to give attention to or invest other resources in improving the educational performance of their children (McKenzie and Rapoport 2011). In addition, the OLS estimation of Equation (1) may suffer from reverse causality problems. For example, liquidity-constrained households may send adult household members to cities in order to raise money for the children's education. Finally, there may be measurement errors in the self-reported remittance status. People are usually reluctant to reveal their income information to strangers like enumerators, although underreporting problems may be less serious when respondents are simply asked whether they receive remittances, and are not asked to state the amounts of the remittances received.²⁸ To address these econometric concerns, the instrument variables method will be used here.

The key empirical challenge in this case is to identify the effect of migration on the educational performance of left-behind children. Following the existing migration literature (such as de Brauw 2010; Démurger and Xu 2011; McKenzie and Rapoport 2011; Mendola 2008; Meyerhoefer and Chen 2011; Taylor and Lopez-Feldman 2010; Zhao 2003), I use the migration network variables to instrument for different migration strategies.²⁹ It is widely recognized that access to a migration network can lower migration costs, and may thus facilitate the migration of others in the same household or village. In addition, people may imitate others in the same household or village who migrate to cities and send remittances home. Therefore, I use the following two types of migration network variables: (1) village-level migration networks, which provide help or information across households in a single village; and (2) family migration chains, in which household members provide support to others in the same household.

²⁷ Generally, the main variable that may be omitted is household wealth, since liquidity-constrained families are more likely to send family members to cities, and the educational performance of children can be affected by their household wealth (Mendola 2008). However, because I have included the household wealth variable in the outcome equation, this concern may not be serious.

²⁸ If the empirical results show that remittances have a positive and statistically significant effect on children's educational performance, then we can safely conclude that the effect of remittances is positive.

²⁹ The gold standard in dealing with the endogeneity problem is the use of randomized experiments, such as the migration lottery program in New Zealand (Gibson, McKenzie, and Stillman 2011). However, this type of migration-related experiment is unavailable in the setting of China. To address the possible endogeneity problems, I employ the instrumental variables method in this paper.

The first village-level migration network variable is the ratio of migrant households in the village, dropping the observed household.³⁰ Another village-level migration network variable is related to the village norm regarding the sending of remittances, as the remitting behavior of migrants can be affected by other people in their community (Atamanov and Berg 2012; Rozelle, Taylor, and de Brauw 1999; Taylor, Rozelle, and de Brauw 2003). This variable is constructed in a similar manner, by using the proportion of remittance-receiving migrant households in the village, and dropping the observed household.³¹ Finally, the family migration chain variable is a dummy for the presence of more than one migrant in the household four years prior to the point at which the survey was taken.³² Since these instrument variables are either community-level variables or they are related to family migration four years before, they should be related to the household's current migration strategies, but they might not have direct effects on the children's educational performance (i.e., test scores on Chinese language and math exams) after other household and community characteristics have been controlled for.

As is usually the case with instrument variables, the instrument variables used in this paper could have some shortcomings. For example, one threat to the validity of the instruments is their correlation with household wealth. It is possible that the presence of more than one migrant in the household four years ago will have enhanced the size of household wealth, which would also be beneficial for the education of the children left behind. Therefore, I control for the household wealth level in the equation. To avoid the possible endogeneity of the household wealth variable, I use the log of household home values (subtracting the value of an average newly built house in the area in 2004), as in rural China the value of the household's home can make up a large share of the household's long-term wealth (de Brauw and Rozelle 2008).³³

³⁰ The mean value of this village-level migration network variable is 31%, with only about 4% of rural households living in villages where the ratio of migrant households is below 10%.

³¹ The mean value of this village-level norm to remit is 15%, with about 30% of rural households living in villages where the ratio of remittance-receiving households is below 10%. However, the village-level migration network variables constructed above may not be valid instruments. That is, the village-level migration network may be a reflection of individual migration status, and may directly affect the outcome of interest (i.e., children's education) rather than through its effects on individual migration or remitting behaviors. I will elaborate on this point later.

³² The family migration chain variable is constructed based on the 2000 wave of GSCF. De Brauw (2010), Mendola (2008), and Mendola and Carletto (2012) also used similar family migration network instrument variables. Only 6% of sample migrant households had more than one migrant in 2000.

³³ Although rural people may use a large share of their remittances to build houses if there are boys in the family who are near marriage age, the overall proportion of remittances used in housing for all of the sample families should be relatively low. For example, according to Li, Mao, and Zhang (2008), only about 6% of rural migrants send remittances home that are used to pay for housing. Instead, most of the remittance amounts are channeled into daily consumption, children's education, and supporting elderly parents. However, it is still possible that the wealth effect may capture the effect of past remittances, which can be

However, it is still possible that the migration of adult household members in 2000 may have affected the educational performance of the children living in the rural home in 2004 through channels other than the migration status in 2004. For instance, the migration of adult household members in 2000 may have directly affected the children's education at that time, and the effect may have persisted through 2004. But because the aim of this study is to gauge short-term migration effects, the above concerns do not pose serious threats to the validity of the household migration chain instrument variable used in this paper. To minimize those concerns, I will also repeat the analysis by dropping the household migration chain variable from the set of instrument variables to check the robustness of the results.³⁴

On the other hand, if villages with larger ratios of migrant households that do not receive remittances tend to have poor educational infrastructure, the children in those villages are likely to have lower test scores. Similarly, if villages with larger ratios of remittance-receiving households tend to have better educational infrastructure because the remittances can be invested in local educational infrastructure, the children may tend to perform better at school. That is, the estimates for the effects of both absence and remittances effect might be overestimated.³⁵ To address these concerns, I include in the equation the per capita net income at the village level, since local governments in more economically developed regions will be able to invest more in local school infrastructure (Murphy and Johnson 2009). In addition, the village-level questionnaire provides information on how much money the villagers had collected in the preceding year to improve school quality, with the following four response options: a lot of money, some money, very little money, and none.³⁶ I include this variable in the equation to control for the possible effect of remittances on local educational infrastructure if a portion of the money collected came from migrant remittances.

A two-stage econometric model is proposed to investigate the effect of migration on the education of the children who remain in the origin communities. In the first stage, a multinomial logit model can be used to estimate the household choice with three options: not migrating, migrating but not remitting, and migrating and remitting.

$$M_i^C = \gamma_0 + \gamma_1 X_i^C + \gamma_2 Z_i + u_i \quad (2)$$

where M^C is a categorical variable indicating household migration choices (i.e., not migrating, migrating but not remitting, and migrating and remitting); X^C is a set of

invested in housing. Since I have only one year of remittances data, this concern cannot be addressed in this paper.

³⁴ The results are shown in Table A2. After dropping the family migration chain variable from the set of instrument variables, the results are very similar to corresponding findings in Table 6 and Table 7.

³⁵ I would like to thank one of the reviewers for her suggestion on this issue.

³⁶ The proportions of the four choices are 3%, 47%, 22%, and 28%.

household and community characteristics in line with the existing migration literature; and Z represents the migration network instrument variables. In the second stage, the predicted probabilities of different household migration strategies from the first stage will be used to evaluate the effect of migration on the children's educational performance levels, which are represented by standardized Chinese language and math test scores.

In the following analysis, I will instead use the two-stage linear probability model to examine the determinants of the educational performance of left-behind children, since the linear probability model allows us to conveniently implement the two-stage IV estimation procedure (Amuedo-Dorantes and Pozo 2010; Angrist 2001). In addition, because about 46% of the sample households have two children included in the dataset, I compute the robust standard errors clustered at the household level.³⁷

5. Estimation results

5.1 OLS results

Table 5 reports the OLS estimation of the determinants of the children's standardized Chinese language and math test scores. In order to directly capture the effects of both the absence and the remittances, I use migrant household that do not receive remittances as the reference group. As we can see in the first two rows, the absence of other adult household members has a negative effect on children's educational performance, but remittances can at least partially compensate for this loss. Furthermore, the above effects seem to be larger for children's performance levels in Chinese language than in math.

As expected, parental education has a positive and statistically significant effect on children's performance levels in both Chinese language and math, which suggests that parental human capital plays a key role in children's development (Brown 2006; Zhao and Glewwe 2010). Household wealth also has a positive effect on children's performance at school, as rich families can invest more money in the education of their children. Finally, children whose families live close to the primary school seem to perform better at school, while children whose families live farther away from the middle school tend to outperform those children whose family live closer.³⁸

³⁷ I have also repeated the analysis by clustering at the village level. I obtained similar results, but with a relatively larger variance.

³⁸ The results on the distances to schools are very similar to those of Zhao and Glewwe (2010). In rural China, students attending middle school usually live at the school dormitory if their homes are far away from school, and return home only weekly or monthly. By contrast, primary school students seldom live at school, and they usually return home every day. Living a long distance away would make attending school costly for

Hu: Does migration benefit the schooling of children remaining behind?

Table 5: Migration and children's educational performance: OLS results

	Chinese language				Math	
	(1)	(2)	(3)	(4)	(5)	(6)
Migration household (Reference group: migrant household without remittances)						
Non-migrant household	0.086 (0.056)	0.094* (0.056)	0.101* (0.056)	0.061 (0.057)	0.063 (0.057)	0.08 (0.057)
Migrant household with remittances	0.135* (0.077)	0.147* (0.078)	0.145* (0.078)	0.057 (0.079)	0.078 (0.08)	0.075 (0.08)
Child characteristics						
Male	0.052 (0.041)	0.057 (0.041)	0.058 (0.041)	0.109*** (0.039)	0.105*** (0.04)	0.104*** (0.04)
Age	-0.023** (0.011)	-0.031*** (0.011)	-0.031*** (0.011)	-0.013 (0.011)	-0.017 (0.011)	-0.017 (0.011)
First born	0.008 (0.045)	0.046 (0.047)	0.042 (0.047)	-0.023 (0.046)	-0.007 (0.047)	-0.013 (0.047)
Household characteristics						
Size		-0.032 (0.027)	-0.025 (0.028)		0.009 (0.028)	0.025 (0.028)
Number of children		0.081** (0.04)	0.076* (0.041)		0.002 (0.043)	-0.011 (0.043)
Father's education		0.015** (0.006)	0.015** (0.006)		0.013** (0.006)	0.012* (0.006)
Mother's education		0.014** (0.007)	0.015** (0.007)		0.012* (0.006)	0.012* (0.007)
Land		0.002 (0.003)	-0.001 (0.003)		0.005* (0.003)	0.00001 (0.003)
Wealth		0.033** (0.014)	0.032** (0.014)		0.008 (0.013)	0.006 (0.013)
Community characteristics						
Distance to primary school			-0.026** (0.011)			-0.053*** (0.011)
Distance to middle school			0.015** (0.006)			0.026*** (0.007)
Distance to the nearest road			0.002 (0.007)			0.001 (0.006)
Constant	0.221 (0.164)	-0.209 (0.213)	-0.242 (0.217)	0.076 (0.169)	-0.181 (0.221)	-0.214 (0.222)
R2	0.004	0.016	0.019	0.005	0.011	0.023
Observations	2534	2530	2530	2528	2524	2524

Note: ① Standard deviations are in parentheses. ② *** significant at 1%, ** significant at 5%, * significant at 10%. ③ All results are robust variance estimates clustered at the household level.

primary school students (Edwards and Ureta 2003). Therefore, distance has a negative effect on primary school students' educational performance, but may not represent a large cost for middle school students. The positive effect on the distance to middle school may reflect some unobserved aspects of middle school quality or unobserved child characteristics associated with distances. For example, the children whose families live far away from schools may study harder and be more self-motivated.

Overall, the OLS results suggest that the absence of adult household members has a negative effect on the educational performance of the children left behind, while the effects of remittances are positive, although the effect on performance in math is not statistically significant. However, the OLS results may be subject to estimation bias due to the endogeneity of migration status. In the following, I examine this issue more closely using the IV method.

5.2 Instrumental variables method

Table 6 displays the second-stage regression results for the educational outcomes of left-behind children. The first-stage linear probability model estimates for household migration choices are presented in Table A1.³⁹ All of the instrument variables are statistically significant, at least at the 5% level. Several other interesting findings emerge from the first-stage regressions. First, the amount of land a household owns has a negative effect on the likelihood of migrating. This suggests that the labor burden from agricultural activities may prevent rural people from migrating to cities, as the land rental markets and the labor markets are undeveloped in rural China. Another interesting finding is that the number of children has a statistically significant and positive effect on the likelihood of being a migrant household that receives remittances, which suggests that there is a need for remittances that can be invested in the education of the children left behind in the origin communities.

To obtain consistent IV results, the selected instrument variables should satisfy the following two conditions. First, the instruments should be correlated with potentially endogenous migration variables. The F-statistic of joint significance of selected instruments at the first stage should generally be more than 10, according to the rule of thumb proposed by Staiger and Stock (1997). However, in the case of multiple endogenous variables, the Cragg-Donald statistic is better for testing the weak instruments (Cragg and Donald 1993; Stock, Wright, and Yogo 2002). As we can see in Table 6, all of the Cragg-Donald statistics are above the critical value of 10% of the maximal IV size, which indicates that the weak instruments have been rejected.

Second, the instruments should be exogenous to the outcomes of interest. Although this assumption cannot be directly tested, we can use the over-identification test, since the number of selected instruments exceeds the number of possible endogenous regressors. The Hansen J-test results at the bottom of Table 6 show that the null hypothesis of instrument exogeneity cannot be rejected at the conventional level of significance. Thus, the instruments appear to be correctly excluded from the outcome equation.

³⁹ The first-stage multinomial logit estimates are very similar to the linear probability model results.

After accounting for the endogeneity of household migration-related variables, the IV regressions yield results that differ from the previous OLS results. Although the signs of migration variables are roughly the same as in the OLS results, the magnitudes and degrees statistical significance are different.⁴⁰ Living in a migrant household that receives no remittances has a negative effect on children’s performance on Chinese language tests, while living in a remittance-receiving migrant household has a positive effect. The two effects are both statistically significant at the 5% level. In addition, the absence of adult household members and remittances do not have statistically significant effects on children’s performance on math exams.

Even after controlling for the per capita net income at the village level and the money collected to improve school quality, as shown in the second and fourth columns of Table 6, the results are still very similar. It should be noted that money collected by villagers seems to have a negative effect on children's educational performance, which is contrary to our expectations. A possible explanation for this finding is that the villagers may have felt the need to raise money to improve the quality of an otherwise underperforming school.⁴¹ Therefore, the fact that the villagers raised money to improve the school may simply reflect the poor quality of the local schools.

Table 6: Migration and children’s educational performance: IV results

	Chinese language		Math	
	(1)	(2)	(3)	(4)
Migration household (Reference group: migrant household without remittances)				
Non-migrant household	1.113*** (0.413)	1.042*** (0.402)	0.273 (0.378)	0.237 (0.386)
Migrant household with remittances	2.007*** (0.675)	1.729** (0.713)	1.002 (0.65)	0.918 (0.715)
Child characteristics				
Male	0.049 (0.046)	0.052 (0.045)	0.093** (0.041)	0.093** (0.041)
Age	-0.037*** (0.014)	-0.034** (0.014)	-0.029** (0.013)	-0.028** (0.014)
First-born	0.08 (0.064)	0.063 (0.064)	0.046 (0.059)	0.042 (0.061)
Household characteristics				
Size	-0.028 (0.033)	-0.026 (0.032)	0.02 (0.029)	0.021 (0.029)

⁴⁰ This may suggest that the attenuation bias (induced by the underreporting of migration-related variables) is larger than the omitted variables bias. The magnitudes of the coefficients on migration-related variables are comparable to those of Lee and Park (2010), who used the same survey data.

⁴¹ In areas with lower fiscal incomes local officials usually charge fees to rural households for education, since local governments are responsible for raising funds for the nine years of compulsory education (Murphy and Johnson 2009).

Table 6: (Continued)

	Chinese language		Math	
	(1)	(2)	(3)	(4)
	(0.055)	(0.054)	(0.054)	(0.056)
Father's education	0.019**	0.019***	0.014**	0.014**
	(0.008)	(0.007)	(0.007)	(0.007)
Mother's education	0.022***	0.021***	0.017**	0.017**
	(0.008)	(0.008)	(0.007)	(0.007)
Land	-0.0003	-0.002	0.002	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
Wealth	0.034**	0.038**	0.005	0.006
	(0.015)	(0.015)	(0.013)	(0.014)
Community characteristics				
Distance to primary school	-0.028**	-0.027*	-0.046***	-0.046***
	(0.014)	(0.014)	(0.012)	(0.012)
Distance to middle school	0.017**	0.012*	0.026***	0.025***
	(0.007)	(0.007)	(0.007)	(0.007)
Distance to the nearest road	-0.0003	0.002	-0.0002	0.002
	(0.007)	(0.007)	(0.006)	(0.007)
Per capita net income (log)		0.003		-0.013
		(0.022)		(0.021)
Money gathered to improve school quality (Reference group: no money)				
Very little money		-0.08		0.0001
		(0.079)		(0.073)
Some money		-0.12*		-0.03
		(0.065)		(0.058)
A lot of money		-0.379**		-0.099
		(0.161)		(0.135)
Constant	-0.987**	-0.915**	-0.226	-0.103
	(0.421)	(0.447)	(0.393)	(0.439)
Weak identification test				
Cragg-Donald Wald F statistic	16.93	13.94	17.25	14.35
Critical value of 10% maximal IV size	13.43			
Critical value of 15% maximal IV size	8.18			
Critical value of 20% maximal IV size	6.40			
Overidentification test of all instruments				
Hansen J statistic: Chi-sq (p-value)	0.26(0.61)	0.44(0.51)	0.7(0.4)	0.62(0.43)
Observations	2530	2530	2524	2524

Note: ① Standard deviations are in parentheses. ② *** significant at 1%, ** significant at 5%, * significant at 10%. ③ All results are robust variance estimates clustered at the household level.

6. Extensions

6.1 Effects differentiated by the gender of children

Because girls in rural China tend to receive a smaller share of a household's educational investments, and they are more likely than boys to be burdened with household chores or other production activities (Brown 2006; Chang, Dong, and Macphail 2011; Hannum, Kong, and Zhang 2009; Lu 2012; Meyerhoefer and Chen 2011), the absence of adult household members and of remittances sent home may have different effects on boys' and girls' educational outcomes.

Table 7 presents the IV results by gender. As in the previous results with the full sample, we can see that the absence of adult household members has a negative effect on the educational performance of the left-behind children, but that remittances seem to partially compensate for this loss. Nevertheless, boys' education does not seem to be greatly affected by the migration of adult household members. By contrast, the absence of adult household members has a large negative effect on girls' educational performance, and the positive effect of remittances is also significant for girls. These results are in line with the descriptive evidence presented in the third section, and with the findings of previous studies (Amuedo-Dorantes and Pozo 2010; Chang, Dong, and Macphail 2011).

It is interesting to note that being the first-born child in the family is good for boys' educational performance, whereas being the oldest child in the family is unfavorable for girls' education, although this negative effect is not statistically significant. Similarly, having a greater number of siblings has a negative effect on girls' education. This may reflect the fact that girls (especially older girls) in rural China usually have to do housework or to take care of younger siblings, even at the expense of their own schooling (Hannum, Kong, and Zhang 2009). By contrast, boys are generally freed from those responsibilities, because parents usually expect boys to focus on their education so they will be in a position to support the household in the future.

Table 7: Migration and children's educational performance by child gender: IV results

	Chinese language		Math	
	Male	Female	Male	Female
Migration household (Reference group: migrant household without remittances)				
Non-migrant household	0.553 (0.53)	1.552*** (0.563)	-0.286 (0.582)	1.13** (0.481)
Migrant household with remittances	1.169 (0.986)	2.23** (0.885)	0.752 (1.094)	1.711** (0.785)
Child characteristics				
Age	-0.058*** (0.017) (0.08)	0.007 (0.023) (0.102)	-0.05** (0.02) (0.086)	0.002 (0.021) (0.091)
Household characteristics				
Size	-0.049 (0.037)	0.011 (0.05)	0.009 (0.038)	0.054 (0.047)
Number of children	0.034 (0.091)	-0.045 (0.069)	-0.102 (0.103)	-0.114 (0.071)
Father's education	0.016* (0.009)	0.019* (0.011)	0.021** (0.01)	0.005 (0.01)
Mother's education	0.014 (0.01)	0.033*** (0.013)	0.007 (0.01)	0.036*** (0.011)
Land	0.001 (0.004)	-0.008 (0.006)	0.005 (0.004)	-0.003 (0.006)
Wealth	0.02 (0.018)	0.065*** (0.023)	-0.005 (0.02)	0.029 (0.02)
Community characteristics				
Distance to primary school	-0.025 (0.018)	-0.026 (0.022)	-0.046*** (0.018)	-0.047*** (0.018)
Distance to middle school	0.017* (0.009)	0.006 (0.012)	0.03*** (0.01)	0.02* (0.011)
Distance to the nearest road	-0.004 (0.009)	0.008 (0.01)	-0.013 (0.01)	0.01 (0.009)
Per capita net income (log)	-0.004 (0.026)	0.018 (0.031)	-0.007 (0.03)	-0.004 (0.028)
Money gathered to improve school quality (Reference group: no money)				
Very little money	-0.129 (0.096)	-0.019 (0.117)	-0.01 (0.096)	-0.007 (0.113)
Some money	-0.009 (0.078)	-0.264*** (0.097)	0.019 (0.079)	-0.113 (0.089)
A lot of money	-0.318 (0.198)	-0.489** (0.23)	0.01 (0.193)	-0.222 (0.197)
Constant	0.098 (0.497)	-2.189*** (0.742)	0.831 (0.573)	-1.44** (0.664)
Weak identification test				
Cragg-Donald Wald F statistic	6.08	8.77	6.64	8.33
Critical value of 10% maximal IV size	13.43			
Critical value of 15% maximal IV size	8.18			
Critical value of 20% maximal IV size	6.40			
Overidentification test of all instruments				
Hansen J statistic: Chi-sq (p-value)	0.38(0.54)	0.03(0.87)	1.09(0.3)	0.02(0.9)
Observations	1402	1128	1399	1125

Note: ① Standard deviations are in parentheses. ② *** significant at 1%, ** significant at 5%, * significant at 10%. ③ All results are robust variance estimates clustered at the household level.

6.2 Parents' migration instead of migration of household members

The impact of parental migration on children's education may be very different from that of migration by siblings or other relatives. For example, the absence of a parent may create more disruption than the absence of a sibling because parents generally take on more responsibility for educating their children than the children's siblings would. In addition, the relevant literature mainly focuses on the effects of parental migration. Therefore, to make the results in this paper comparable, I will repeat the above analysis while only including parental migration-related variables in the model.⁴²

Table 8 reports the IV estimation results using parental migration only. Overall, the findings are very similar to the results of previous analyses in which the migration behaviors of all of the adult household members were included. These results suggest that it may be equally useful to consider the migration of adult siblings when studying the effects of migration in the household on children's education.⁴³

Table 8: Migration and children's educational performance using parental migration only: IV results

	Chinese language			Math		
	Total	Male	Female	Total	Male	Female
Migration household (Reference group: migrant household without remittances)						
Non-migrant household	1.048** (0.425)	0.759 (0.689)	1.313*** (0.494)	0.3 (0.417)	-0.367 (0.737)	0.991** (0.429)
Migrant household with remittances	1.721** (0.817)	1.584 (1.318)	1.704* (0.876)	1.183 (0.845)	0.65 (1.411)	1.451* (0.827)
Child characteristics						
Male	0.057 (0.044)			0.099** (0.041)		
Age	-0.028** (0.012)	-0.051*** (0.015)	0.007 (0.019)	-0.018 (0.012)	-0.032** (0.016)	0.004 (0.018)
First born	0.043 (0.05)	0.136* (0.077)	-0.078 (0.074)	-0.009 (0.048)	-0.008 (0.076)	-0.051 (0.07)
Household characteristics						
Size	-0.022 (0.032)	-0.049 (0.039)	0.019 (0.049)	0.017 (0.03)	-0.001 (0.038)	0.059 (0.047)

⁴² Among the 771 migrants in the sample, migrants who have children account for about one-half of the total (50.5%=389/771), and 31% of them have sent money home in the preceding year. Among the parents who migrate, the proportion who send remittances is lower than the share of 47% found for all migrant household members. This may be because some of the parents take some of their children with them to the city, and are thus less likely to send remittances home than other household members, such as the children's siblings.

⁴³ In rural China, especially in poor rural areas, it is very common for elder siblings to migrate to cities to seek non-agricultural job opportunities. According to Lu (2012), the scale of siblings' migration is almost comparable to that of parental migration in rural China. Many rural children start their migration journey soon after finishing middle school.

Table 8: (Continued)

	Chinese language			Math		
	Total	Male	Female	Total	Male	Female
	(0.047)	(0.06)	(0.072)	(0.048)	(0.065)	(0.071)
Father's education	0.019*** (0.007)	0.015 (0.01)	0.022** (0.01)	0.013** (0.007)	0.017* (0.009)	0.008 (0.01)
Mother's education	0.018** (0.008)	0.013 (0.01)	0.026** (0.011)	0.015** (0.007)	0.003 (0.009)	0.03*** (0.01)
Land	-0.003 (0.003)	0.0001 (0.004)	-0.01* (0.006)	0.001 (0.004)	0.005 (0.004)	-0.005 (0.006)
Wealth	0.039*** (0.015)	0.016 (0.019)	0.069*** (0.022)	0.005 (0.014)	-0.01 (0.021)	0.032 (0.02)
Community characteristics						
Distance to primary school	-0.03** (0.013)	-0.032* (0.019)	-0.027 (0.019)	-0.049*** (0.011)	-0.05*** (0.019)	-0.048*** (0.017)
Distance to middle school	0.014* (0.007)	0.018* (0.01)	0.01 (0.011)	0.026*** (0.007)	0.03*** (0.01)	0.023** (0.011)
Distance to the nearest road	0.002 (0.007)	-0.005 (0.009)	0.009 (0.01)	0.001 (0.007)	-0.014 (0.01)	0.011 (0.009)
Per capita net income (log)	-0.004 (0.022)	-0.005 (0.028)	0.001 (0.028)	-0.014 (0.02)	-0.001 (0.03)	-0.017 (0.026)
Money gathered to improve school quality (Reference group: no money)						
Very little money	-0.124* (0.075)	-0.158* (0.094)	-0.065 (0.111)	-0.011 (0.071)	-0.007 (0.089)	-0.035 (0.111)
Some money	-0.129** (0.065)	-0.016 (0.08)	-0.289*** (0.097)	-0.027 (0.059)	0.025 (0.075)	-0.125 (0.09)
A lot of money	-0.487*** (0.143)	-0.382** (0.18)	-0.639*** (0.199)	-0.161 (0.121)	-0.056 (0.161)	-0.328* (0.176)
Constant	-0.993** (0.467)	-0.225 (0.643)	-1.863*** (0.637)	-0.292 (0.473)	0.573 (0.702)	-1.269** (0.598)
Weak identification test						
Cragg-Donald Wald F statistic	16.3	5.15	13.02	15.99	5.33	12.22
Critical value of 10% maximal IV size	13.43					
Critical value of 15% maximal IV size	8.18					
Critical value of 20% maximal IV size	6.40					
Critical value of 25% maximal IV size	5.45					
Overidentification test of all instruments						
Hansen J statistic: Chi-sq (p-value)	0.97(0.33)	0.28(0.59)	0.86(0.35)	0.07(0.79)	0.86(0.35)	0.7(0.4)
Observations	2530	1402	1128	2524	1399	1125

Note: ① Standard deviations are in parentheses. ② *** significant at 1%, ** significant at 5%, * significant at 10%. ③ All results are robust variance estimates clustered at the household level.

To sum up, the overall findings suggest that living in a migrant household that receives no remittances has a negative effect on children's performance, but that remittances at least partially compensate for this loss. The two effects differ by gender: boys' educational performance does not seem to be greatly affected by the migration of adult household members. By contrast, the absence of adult household members has a large negative effect on girls' educational performance, and the positive effect of remittances is also significant for girls.

7. Conclusions

Since the implementation of China's reform and opening-up policy in the late 1970s, the trend toward rural-urban migration has continued unabated. However, due to the existing institutional barriers, most children in migrant households are denied access to high-quality educational opportunities in the cities, and have to remain behind in rural areas. In this study, I examined the effects of this huge internal migration flow on the educational performance of the children who are left behind in rural areas using survey data from Gansu, a western province of China. In order to better understand the underlying mechanisms of the effects of migration on children's education, I attempted to disentangle the effects of remittances from the effects of migration.

After accounting for the endogeneity of migration variables, I found that the departure of adult household members (including the parents) has a negative effect on the educational performance of the children who remain behind in rural China. On the other hand, the results showed that the money remitted by the migrants plays a positive role in promoting the children's educational performance, which appears to contradict the pessimistic assumption that remittances are mostly channeled into short-term consumption, and thus do not contribute to human capital development. Finally, the above effects differed by gender: boys' educational performance was not found to be greatly affected by the migration of adult household members. By contrast, the absence of adult household members was found to have a large negative effect on girls' educational performance, and the positive effect of remittances was also shown to be significant for girls.

However, some caution should be exercised when interpreting the empirical results of this paper. As was pointed out by Edwards and Ureta (2003), the impact of migration on the education of the children left behind can be long lasting. However, the information available in the dataset used in this paper only covers the migration behavior of household members over the preceding year. If migrants who have been in cities for long periods of time are less likely to send remittances home, or if some rural people had migrated before but had stayed home in the preceding year, then the estimated effects of migration and remittances found in this paper would be biased. The investigation of these possible problems must be left for future research, when better quality datasets are available.

Nevertheless, the above findings may be of interest to policy makers in other developing countries with large internal migration flows, as remittances sent home by out-migrants may serve as a channel for investment in human capital, especially of girls, in the regions of origin. Since investments in girls' education are usually smaller than those in boys' education, and since girls are more likely than boys to be assigned

responsibility for household chores and income-generating activities, the remittances may be particularly important for the education and future development of girls.

8. Acknowledgements

I would like to acknowledge the valuable comments and suggestions made by two anonymous referees, by participants in the 8th CWE (Chinese Women Economists) International Workshop on Empirical Research Using Micro Data, and in particular by Professor Lingsheng Meng from Tsinghua University. I wish to further acknowledge the GSCF survey team for providing the dataset. The Gansu Survey of Children and Families (GSCF) is supported by a grant from the United Kingdom Economic and Social Research Council and Department for International Development (ESRC RES-167-25-0250). Earlier support for data collection came from The Spencer Foundation Small and Major Grants Programs, The World Bank, and NIH Grants 1R01TW005930-01 and 5R01TW005930-02. This study received financial support from the National Natural Science Foundation of China (No: 71003005; 71133003).

References

- Adams Jr., R.H., and Cuecuecha, A. (2010). Remittances, household expenditure and investment in Guatemala. *World Development* 38(11): 1626-1641. doi:[10.1016/j.worlddev.2010.03.003](https://doi.org/10.1016/j.worlddev.2010.03.003).
- Alcaraz, C., Chiquiar, D., and Salcedo, A. (2012). Remittances, schooling, and child labor in Mexico. *Journal of Development Economics* 97(1): 156-165. doi:[10.1016/j.jdevco.2010.11.004](https://doi.org/10.1016/j.jdevco.2010.11.004).
- Amuedo-Dorantes, C., Georges, A., and Pozo, S. (2010). Migration, remittances, and children's schooling in Haiti. *Annals of the American Academy of Political and Social Science* 630(1): 224-244. doi:[10.1177/0002716210368112](https://doi.org/10.1177/0002716210368112).
- Amuedo-Dorantes, C., and Pozo, S. (2010). Accounting for remittance and migration effects on children's schooling. *World Development* 38(12): 1747-1759. doi:[10.1016/j.worlddev.2010.05.008](https://doi.org/10.1016/j.worlddev.2010.05.008).
- Angrist, J.D. (2001). Estimation of limited dependent variable models with dummy endogenous regressors: Simple strategies for empirical practice. *Journal of Business & Economic Statistics* 19(1): 2-28. doi:[10.1198/07350010152472571](https://doi.org/10.1198/07350010152472571).
- Antman, F.M. (2012). Gender, educational attainment, and the impact of parental migration on children left behind. *Journal of Population Economics* 25(4): 1187-1214. doi:[10.1007/s00148-012-0423-y](https://doi.org/10.1007/s00148-012-0423-y).
- Arguillas, M.B. and Williams, L. (2010). The impact of parents' overseas employment on educational outcomes of Filipino children. *International Migration Review* 44(2): 300-319. doi:[10.1111/j.1747-7379.2010.00807.x](https://doi.org/10.1111/j.1747-7379.2010.00807.x).
- Atamanov, A. and Berg, M. (2012). Heterogeneous effects of international migration and remittances on crop income: Evidence from the Kyrgyz Republic. *World Development* 40(3): 620-630. doi:[10.1016/j.worlddev.2011.07.008](https://doi.org/10.1016/j.worlddev.2011.07.008).
- Atkin, D.G. (2012). Endogenous skill acquisition and export manufacturing in Mexico. MA: National Bureau of Economic Research (NBER working paper; No. 18266). doi:[10.3386/w18266](https://doi.org/10.3386/w18266).
- Bansak, C. and Chezum, B. (2009). How do remittances affect human capital formation of school-age boys and girls? *American Economic Review Papers and Proceedings* 99(2): 145-148. doi:[10.1257/aer.99.2.145](https://doi.org/10.1257/aer.99.2.145).

- Berker, A. (2009). The impact of internal migration on educational outcomes: Evidence from Turkey. *Economics of Education Review* 28(6): 739-749. doi:10.1016/j.econedurev.2009.03.003.
- Bredl, S. (2011). Migration, remittances and educational outcomes: The case of Haiti. *International Journal of Educational Development* 31(2): 162-168. doi:10.1016/j.ijedudev.2010.02.003.
- Brown, P.H. (2006). Parental education and investment in children's human capital in rural China. *Economic Development and Cultural Change* 54(4): 759-789. doi:10.1086/503582.
- Calero, C., Bedi, A.S., and Sparrow, R. (2009). Remittances, liquidity constraints and human capital investments in Ecuador. *World Development* 37(6): 1143-1154. doi:10.1016/j.worlddev.2008.10.006.
- Chan, K. and Buckingham, W. (2008). Is China abolishing the hukou system? *The China Quarterly* 195: 582-606.
- Chang, H., Dong, X., and MacPhail, F. (2011). Labor migration and time use patterns of the left-behind children and elderly in rural China. *World Development* 39(12): 2199-2210. doi:10.1016/j.worlddev.2011.05.021.
- Chen, X., Huang, Q., Rozelle, S., Shi, Y., and Zhang, L. (2009). Effect of migration on children's educational performance in rural China. *Comparative Economic Studies* 51(3): 323-343. doi:10.1057/ces.2008.44.
- Cragg, J.G. and Donald, S.G. (1993). Testing identifiability and specification in instrumental variable models. *Econometric Theory* 9(2): 222-240. doi:10.1017/S0266466600007519.
- de Brauw, A. and Giles, J. (2008). Migrant opportunity and the educational attainment of youth in rural China. Washington D.C.: The World Bank (Policy Research Working Paper Series; No. 4526). doi:10.1596/1813-9450-4526.
- de Brauw, A. and Rozelle, S. (2008). Migration and household investment in rural China. *China Economic Review* 19(2): 320-335. doi:10.1016/j.chieco.2006.10.004.
- de Brauw, A. (2010). Seasonal migration and agricultural production in Vietnam. *Journal of Development Studies* 46(1): 114-139. doi:10.1080/00220380903197986.

Hu: Does migration benefit the schooling of children remaining behind?

- Démurger, S. and Xu, H. (2011). Return migrants: The rise of new entrepreneurs in rural China. *World Development* 39(10): 1847-1861. doi:10.1016/j.worlddev.2011.04.027.
- Duan, C. and Zhou, F. (2005). Research on China's left-behind children. *Population Research (in Chinese)* 29(1): 29-36.
- Edwards, A. and Ureta, M. (2003). International migration, remittances, and schooling: evidence from El Salvador. *Journal of Development Economics* 72(2): 429-461. doi:10.1016/S0304-3878(03)00115-9.
- Gansu Provincial Bureau of Statistics (2007). Gansu migrant survey report (in Chinese). Lanzhou: Gansu Provincial Bureau of Statistics. <http://www.gstj.gov.cn/doc/ShowArticle.asp?ArticleID=221>.
- Gibson, J., McKenzie, D., and Stillman, S. (2011). The impacts of international migration on remaining household members: omnibus results from a migration lottery program. *Review of Economics and Statistics* 93(4): 1297-1318. doi:10.1162/REST_a_00129.
- Glewwe, P. and Kremer, M. (2006). Schools, teachers, and education outcomes in developing countries. In: Hanushek, E.A. and Welch, F. (eds.). *Handbook of the Economics of Education, Volume 2*. Amsterdam: North Holland: 945-1017.
- Hannum, E., Kong, P., and Zhang, Y. (2009). Family sources of educational gender inequality in rural China: A critical assessment. *International Journal of Educational Development* 29(5): 474-486. doi:10.1016/j.ijedudev.2009.04.007.
- Hanson, G.H. and Woodruff, C. (2003). Emigration and educational attainment in Mexico. San Diego: University of California – San Diego (UCSD School of International Relations and Pacific Studies working paper).
- Hu, F. (2012). Migration, remittances, and children's high school attendance: The case of rural China. *International Journal of Educational Development* 32(3): 401-411. doi:10.1016/j.ijedudev.2011.08.001.
- Hu, F., Xu, Z., and Chen, Y. (2011). Circular migration or permanent stay? Evidence from China's rural-urban migration. *China Economic Review* 22(1): 64-74. doi:10.1016/j.chieco.2010.09.007.
- Jensen, P. and Nielsen, H.S. (1997). Child labour or school attendance? Evidence from Zambia. *Journal of Population Economics* 10(4): 407-424. doi:10.1007/s001480050051.

- Jia, Z. and Tian, W. (2010). Loneliness of left-behind children: A cross-sectional survey in a sample of rural China. *Child: Care, Health and Development* 36(6): 812-817. doi:10.1111/j.1365-2214.2010.01110.x.
- Kong, S.T. and Meng, X. (2010). The educational and health outcomes of the children of migrants. In: Meng, X., Manning, C., Li, S., and Effendi, T. (eds.). *The great migration: Rural-urban migration in China and Indonesia*. Northampton, MA: Edward Elgar: 97-120.
- Kuhn, R. (2006). The effects of fathers' and siblings' migration on children's pace of schooling in rural Bangladesh. *Asian Population Studies* 2(1): 69-92. doi:10.1080/17441730600700572.
- Lee, L. and Park, A. (2010). Parental migration and child development in China. PA: University of Pennsylvania (Gansu Survey of Children and Families Working Paper).
- Lee, M. (2011). Migration and children's welfare in China: The schooling and health of children left behind. *Journal of Developing Areas* 44(2): 165-182. doi:10.1353/jda.0.0104.
- Li, Q., Mao, X., and Zhang, T. (2008). China's migrant remittances: Decision, magnitude, and use. *China Rural Survey (in Chinese)* 3: 2-12.
- Lu, Y. (2012). Education of children left behind in rural China. *Journal of Marriage and Family* 74(2): 328-341. doi:10.1111/j.1741-3737.2011.00951.x.
- Mansour, W., Chaaban, J., and Litchfield, J. (2011). The impact of migrant remittances on school attendance and education attainment: Evidence from Jordan. *International Migration Review* 45(4): 812-851. doi:10.1111/j.1747-7379.2011.00869.x.
- McKenzie, D. and Rapoport, H. (2011). Can migration reduce educational attainment? Evidence from Mexico. *Journal of Population Economics* 24(4): 1331-1358. doi:10.1007/s00148-010-0316-x.
- Mendola, M. (2008). Migration and technological change in rural households: complements or substitutes? *Journal of Development Economics* 85(1-2): 150-175. doi:10.1016/j.jdeveco.2006.07.003.
- Mendola, M. and Carletto, C. (2012). Migration and gender differences in the home labour market: Evidence from Albania. *Labour Economics* 19(6): 870-880. doi:10.1016/j.labeco.2012.08.009.

Hu: Does migration benefit the schooling of children remaining behind?

- Meyerhoefer, C.D. and Chen, C.J. (2011). The effect of parental labor migration on children's educational progress in rural China. *Review of Economics of the Household* 9(3): 379-396. doi:10.1007/s11150-010-9105-2.
- Ministry of Agriculture of PRC (2005). *China agricultural statistical yearbook 2005 (in Chinese)*. Beijing: China Agricultural Press.
- Mueller, V. and Shariff, A. (2011). Preliminary evidence on internal migration, remittances, and teen schooling in India. *Contemporary Economic Policy* 29(2): 207-217. doi:10.1111/j.1465-7287.2010.00211.x.
- Murphy, R. and Johnson, D. (2009). Education and development in China – Institutions, curriculum and society. *International Journal of Educational Development* 29(5): 447-453. doi:10.1016/j.ijedudev.2009.06.003.
- National Bureau of Statistics of China (2005a). *China rural household survey yearbook 2005 (in Chinese)*. Beijing: China Statistics Press.
- National Bureau of Statistics of China (2005b). *China statistical yearbook 2005 (in Chinese)*. Beijing: China Statistics Press.
- National Bureau of Statistics of China (2012). Monitoring survey report of rural migrants in 2011 (in Chinese). Beijing: National Bureau of Statistics of China. http://www.stats.gov.cn/tjfx/fxbg/t20120427_402801903.htm.
- Rozelle, S., Taylor, J.E., and de Brauw, A. (1999). Migration, remittances, and agricultural productivity in China. *American Economic Review Papers and Proceedings* 89(2): 287-291. doi:10.1257/aer.89.2.287.
- Staiger, D. and Stock, J.H. (1997). Instrumental variables regression with weak instruments. *Econometrica* 65(3): 557-586. doi:10.2307/2171753.
- Stock, J.H., Wright, J.H., and Yogo, M. (2002). A survey of weak instruments and weak identification in generalized method of moments. *Journal of Business and Economic Statistics* 20(4): 518-529. doi:10.1198/073500102288618658.
- Tan, S. (2011). A literature review on China's rural left-behind children. *Social Sciences in China (in Chinese)* 32(1): 138-150.
- Taylor, J.E. and Lopez-Feldman, A. (2010). Does migration make rural households more productive? Evidence from Mexico. *Journal of Development Studies* 46(1): 68-90. doi:10.1080/00220380903198463.

- Taylor, J.E., Rozelle, S., and de Brauw, A. (2003). Migration and incomes in source communities: A new economics of migration perspective from China. *Economic Development and Cultural Change* 52(1): 75-101. doi:10.1086/380135.
- The World Bank (2011). *Migration and remittances factbook 2011 (Second Edition)*. Washington D.C.: World Bank Publications.
- Woodruff, C. and Zenteno, R. (2007). Migration networks and microenterprises in Mexico. *Journal of Development Economics* 82(2): 509-528. doi:10.1016/j.jdeveco.2006.03.006.
- Xiang, B. (2007). How far are the left-behind left behind? A preliminary study in rural China. *Population, Space and Place* 13(3): 179-191. doi:10.1002/psp.437.
- Yang, D. (2008). International migration, remittances and household investment: Evidence from Philippine migrants' exchange rate shocks. *The Economic Journal* 118(528): 591-630. doi:10.1111/j.1468-0297.2008.02134.x.
- Yang, D.T. (1997). China's land arrangements and rural labor mobility. *China Economic Review* 8(2): 101-115. doi:10.1016/S1043-951X(97)90001-8.
- Ye, J., Wang, Y., Zhang, K., and Lu, J. (2006). The impacts of parents' out-migration on the education of left-behind children. *Rural Economy (in Chinese)* 7: 119-123.
- Zhao, M. and Glewwe, P. (2010). What determines basic school attainment in developing countries? Evidence from rural China. *Economics of Education Review* 29(3): 451-460. doi:10.1016/j.econedurev.2009.10.008.
- Zhao, Y. (2003). The role of migrant networks in labor migration: The case of China. *Contemporary Economic Policy* 21(4): 500-511. doi:10.1093/cep/byg028.

Hu: Does migration benefit the schooling of children remaining behind?

Appendix

Table A1: Linear probability model of migration choices: First-stage results

	Non-migrant household	Migrant household with remittances
Child characteristics		
Male	-0.005 (0.016)	-0.009 (0.031)
Age	-0.016*** (0.005)	0.045*** (0.01)
First born	0.052*** (0.016)	-0.152*** (0.034)
Household characteristics		
Size	0.007 (0.013)	0.019 (0.031)
Number of children	0.009 (0.02)	0.079* (0.041)
Father's education	-0.001 (0.003)	-0.003 (0.005)
Mother's education	-0.001 (0.003)	-0.013** (0.006)
Land	0.002* (0.001)	-0.002 (0.003)
Wealth	-0.004 (0.006)	0.005 (0.014)
Community characteristics		
Distance to primary school	0.007 (0.005)	-0.001 (0.015)
Distance to middle school	-0.002 (0.003)	0 (0.007)
Distance to high school	-0.002 (0.003)	0.004 (0.006)
Per capita net income (log)	-0.005 (0.009)	-0.025 (0.02)
Money gathered to improve school quality (Reference group: no money)		
Very little money	-0.0004 (0.032)	-0.13** (0.063)

Table A1: (Continued)

	Nonmigrant household	Migrant household with remittances
Some money	0.003 (0.027)	-0.055 (0.048)
A lot of money	0.002 (0.063)	-0.246* (0.126)
Migration network		
Ratio of migrant households in the village	-0.626*** (0.097)	-0.413*** (0.16)
Ratio of remittance-receiving households in the village	0.295** (0.143)	0.828*** (0.205)
Presence of more than one migrant in the household	-0.33** (0.131)	-0.037 (0.126)
Constant	1.165*** (0.119)	-0.155 (0.245)
R2	0.064	0.15
Observations	2380	897

Note: ① Standard deviations are in parentheses. ② *** significant at 1%, ** significant at 5%, * significant at 10%. ③ All results are robust variance estimates clustered at the household level. ④ The reference group is a migrant household that receives no remittances.

Table A2: Migration and children's educational performance: Dropping the family migration chain instrument variable

	Chinese language			Math		
	Total	Male	Female	Total	Male	Female
Migration household (Reference group: migrant household without remittances)						
Non-migrant household	1.089*** (0.398)	0.666 (0.542)	1.558*** (0.563)	0.204 (0.391)	-0.421 (0.603)	1.128** (0.483)
Migrant household with remittances	1.687** (0.717)	1.306 (1.009)	2.173** (0.912)	0.965 (0.729)	0.639 (1.105)	1.745** (0.847)
Child characteristics						
Male	0.053 (0.045)			0.092** (0.042)		
Age	-0.032** (0.014)	-0.058*** (0.018)	0.008 (0.024)	-0.029** (0.014)	-0.051** (0.02)	0.002 (0.022)
First born	0.054 (0.066)	0.145* (0.081)	-0.086 (0.109)	0.05 (0.063)	0.067 (0.086)	-0.036 (0.1)
Household characteristics						
Size	-0.026 (0.032)	-0.05 (0.038)	0.012 (0.051)	0.02 (0.029)	0.01 (0.039)	0.053 (0.047)

Hu: Does migration benefit the schooling of children remaining behind?

Table A2: (Continued)

	Chinese language			Math		
	Total	Male	Female	Total	Male	Female
	(0.054)	(0.093)	(0.068)	(0.058)	(0.104)	(0.071)
Father's education	0.019**	0.016*	0.019*	0.015**	0.021**	0.005
	(0.007)	(0.01)	(0.011)	(0.007)	(0.01)	(0.01)
Mother's education	0.021**	0.014	0.033***	0.017**	0.007	0.036***
	(0.008)	(0.01)	(0.013)	(0.007)	(0.01)	(0.011)
Land	-0.003	0.001	-0.008	0.002	0.006	-0.003
	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.007)
Wealth	0.038**	0.02	0.066***	0.006	-0.004	0.029
	(0.015)	(0.018)	(0.023)	(0.014)	(0.021)	(0.021)
Community characteristics						
Distance to primary school	-0.029**	-0.027	-0.027	-0.045***	-0.044**	-0.047**
	(0.014)	(0.018)	(0.022)	(0.012)	(0.018)	(0.019)
Distance to middle school	0.012*	0.017*	0.006	0.024***	0.03***	0.02*
	(0.007)	(0.01)	(0.012)	(0.007)	(0.01)	(0.011)
Distance to the nearest road	0.002	-0.004	0.008	0.001	-0.014	0.01
	(0.007)	(0.009)	(0.01)	(0.007)	(0.01)	(0.009)
Per capita net income (log)	0.003	-0.004	0.018	-0.013	-0.006	-0.005
	(0.022)	(0.027)	(0.03)	(0.021)	(0.03)	(0.028)
Money gathered to improve school quality (Reference group: no money)						
Very little money	-0.087	-0.125	-0.026	0.006	-0.012	-0.002
	(0.08)	(0.098)	(0.125)	(0.075)	(0.096)	(0.12)
Some money	-0.123*	-0.008	-0.268***	-0.027	0.019	-0.11
	(0.065)	(0.079)	(0.102)	(0.059)	(0.079)	(0.094)
A lot of money	-0.393**	-0.313	-0.5**	-0.087	0.01	-0.215
	(0.162)	(0.202)	(0.236)	(0.138)	(0.194)	(0.208)
Constant	-0.975**	0.012	-2.199***	-0.058	0.951	-1.435**
	(0.444)	(0.504)	(0.745)	(0.448)	(0.596)	(0.669)
Weak identification test						
Cragg-Donald Wald F statistic	20.84	8.71	12.19	21.36	9.8	11.28
Critical value of 10% maximal IV size	7.03					
Critical value of 15% maximal IV size	4.58					
Critical value of 20% maximal IV size	3.95					
Critical value of 25% maximal IV size	3.63					
Observations	2530	1402	1128	2524	1399	1125

Note: ① Standard deviations are in parentheses. ② *** significant at 1%, ** significant at 5%, * significant at 10%. ③ All results are robust variance estimates clustered at the household level.