The cumulative impact of parental migration on schooling of left-behind children in rural China

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ABSTRACT

It is widely known that parental migration for off-farm employment plays an important role in the livelihoods of families in rural areas of developing countries. Undoubtedly, it has made contributions to poverty reduction, income increases, and the strengthening of the consumption capacity of rural families. However, research on whether it has a long-term effect on the schooling of laborers' children is still scarce despite the short-run effect of parental migration on children's academic performance receiving considerable attention in recent empirical research. This paper investigates the impact of parental migration for off-farm employment on the schooling years of left-behind children in rural China. We draw on a unique dataset collected by the authors themselves through the nationally representative China Rural Development Survey. By using ordinary least squares and the family fixed effects model, our results show that parental migration increases the educational investment in children, while it has no effect on the schooling years of left-behind children. It implies previous studies using the contemporaneous measure for parental migration might overestimate the adverse effect of exposure to parental migration on children's schooling years. This study makes two contributions to the literature – one, it is the first study in the china context on the cumulative impact of parental migration on schooling years of left-behind children and second, it applies the family fixed effects model to alleviate the endogeneity problems.

1. Introduction

It has been widely believed that parental guardianship has an important impact on the schooling years of the children involved. This issue has become increasingly important in the last two decades for Chinese rural families. Along with the development of China's economy after its reforms and opening-up, especially with the rapid development of labor-intensive industries in the southeastern coastal regions since the 1990s, a notable phenomenon facing China is that not only are more and more rural laborers engaged in off-farm employment, but also that migrational off-farm employment has increasingly become one of the most common types of off-farm employment (Zhang et al., 2018). According to data from the National Bureau of Statistics of China, about 30 million migrant workers left their hometowns in rural China to seek off-farm employment in urban areas and cities in 1995. In 2005, this amount reached 125 million, and in 2015 it further increased to 169 million (National Bureau of Statistics of People's Republic of China, 2016). Although some migrants do bring their children with them, there is still a large number of left-behind children.[1]

There is little doubt that parental migration for off-farm employment is an attractive means of improving a rural family's standard of living. First, it plays an important role in the reduction of poverty and increases

income for rural families (Cai and Wang, 2009; Huang et al., 2011; Zhao et al., 2012; Li et al., 2021). Second, it helps to increase the consumption capacity of rural families (Du et al., 2005; Zhu and Luo, 2010; Park and Wang, 2010; Zhao et al., 2012). Last, it can improve one's ability to engage in self-employment or investment in agricultural production, and thereby help to further increase household income (Rozelle et al., 1999; Giles, 2006; Huang et al., 2011; Zhang et al., 2018). In general, it brings with its large income growth potential for the parents involved.

However, it is unclear whether parental migration for off-farm employment reduces the human capital accumulation of the proceeding generation. The human capital accumulation is likely to be affected in two ways. On the one hand, the lack of parental care has a negative effect on child development (Antman, 2012; Malik, 2015). On the other hand, the income increase due to parental migration may in turn increase educational investment in one's children. As such, the net impact of parental migration depends on the gross effect of these two forces (Meng and Yamauchi, 2017). The extent to which the financial rewards from parental migration for off-farm employment translate into sustained gains in socioeconomic status across generations is still not well understood. In other words, does the income growth of this generation come at the expense of the education of the following generation? If the answer is yes, then the positive effect of parental migration may be overstated.

The educational performance of left-behind children has attracted the attention of many scholars over the past ten years. However, the results of their studies are, to a large extent, mixed. Among them, some studies find that parental migration for off-farm employment has a positive effect on child educational performance (Yang, 2008; Chen et al., 2009; Lee, 2011; Lu, 2012; Bai et al., 2018). The main impact path may be that parental migration for off-farm employment would help to relax family budget constraints; the resultant improvement in educational investment for the children may be helpful to their educational performance (Du et al., 2005; Yang, 2008; Antman, 2012; Malik, 2015). Some other studies have reached the conclusion that parental migration for off-farm employment has a negative impact on children's educational performance (Townsend et al., 2002; Meyerhoefer and Chen, 2011; Wang, 2014; Zhao et al., 2014; Zhou et al., 2014). The mechanism for these results is due to the absence of parental guardianship and thus a lack of the appropriate type of care for the children (Ye and Lu, 2011; Zhang et al., 2014; Zhang et al., 2016). Another possible reason leading to this negative effect may be that left-behind children need to spend more time on farm work or housework due to an insufficient amount of laborers at home while the parents are off seeking employment elsewhere (Antman, 2011; Chang et al., 2011; McKenzie and Rapoport, 2011). As a third outcome type standing in opposition to the above findings, some studies have shown that parental migration for off-farm employment has no effect on the educational performance of left-behind children (Chen, 2013; Xu and Xie, 2015; Zhou et al., 2015). One explanation for this finding is that access to more resources due to parental migration offsets the negative effects of the absence of parental care (Zhou et al., 2015). Another study even shows that a positive understanding of parental motivation for labor migration and commitment to education are significant contributors to the resilience displayed by left-behind adolescents (Hu, 2019).

Although many studies have been conducted on the effect of parental migration for off-farm employment on children's educational performance, the findings of these studies are quite varied and this may be due to the following reasons. First, the sample representativeness of each study is different, and the samples within many of them are small (Ye and Lu, 2011; Lu, 2012; Zhou et al., 2014). Second, the data used in different studies have different measurement methods for child education, and some studies have not measured child education objectively (Chen et al., 2009; Bai et al., 2018). Third, almost all of these studies focus on the impact of parental migration for off-farm employment in the short run; in other words, they focus on the contemporaneous effect. For example, Bai et al. (2018) investigated the impact of whether each

parent had been away from home for two months or more during the semester on child academic performance. Last, most prior studies have not dealt with potential endogeneity problems (Lu, 2012; Zhou et al., 2015).

As far as we know, there is still a lack of long-term perspective for examining the impact of rural parental migration for off-farm employment on child's education. Therefore, the main objective of this study is to investigate the effect of parents' accumulated years of migration for off-farm employment on their children's schooling years during the elementary and junior high school stages in rural China. Furthermore, we examine the effect on these sampled children during their entire compulsory education stage and conduct some other tests and robustness checks. Last, we investigate the effect of parental migration for off-farm employment on the educational investment in their children.

To achieve the objective mentioned above, we collected a unique dataset. The data tracked employment information for all laborers in the sample households for 18 years since 1998. This enabled us to obtain complete information on parental migration for off-farm employment during their children's first nine years of education; We excluded preschool education, as a large amount of rural Chinese people did not have access to it. For the elementary school stage sub-sample of this study, preliminary statistical analysis of the data showed that the average age of sampled children is 21.31 years old. For the junior high school stage sub-sample, it showed that the average age of the sampled children is 24.69 years. The average age of sample individuals in this study is around 21–25 years. So, the enrollment year of preschool education of sample individuals in this study is approximately between 1993 and 1997. According to previous studies and statistical data, the attendance rate of preschool is less than 40% on the national level in China in 2000 (Liang, 2019; Ministry of Education of the People's Republic of China, 2001). Preschool attendance rate for rural areas is much lower considering the huge urban-rural gap in China. There are only 30.2% of villages in China have kindergarten or preschool facilities (National Bureau of Statistics of the People's Republic of China, 2008). The attendance rate of preschool is only 50.9% even in 2009 (China Development Research Foundation, 2020). So, we focus on the nine years from the first grade of elementary school, and they are comprised of the first grade of elementary school to the third grade of junior high school—namely, the compulsory education stage.

The main concern we use parents' total years of migration while children were in elementary school/junior high school is because children's academic performance of these two stages is influenced by their parents to some extent. Parents play a relatively weaker role in children's academic performance when they attended high school since almost all rural students live on campus. They usually go home on statutory holidays due to home and school are very far away. This is especially true for students from rural China. In addition, it is worth mentioning that the data from our survey traced at least three generations of family members in the sample households and collected employment and education information for those persons who lived away from the co-residing family, but who are genetically related to them. This unique data allows us to make full use of the family fixed effects (FFE) estimation method, thus providing a possible way to alleviate potential endogeneity problems. In Section 2, we introduce the data used in this study in greater detail.

By using the ordinary least squares (OLS) and FFE estimation methods, our results show that, overall, parental migration for off-farm employment during children's elementary or junior high school does not have an impact on children's schooling years, though it does have a positive effect on the educational investment in children. This study would help to expand the existing research and enrich the understanding of academia on the long-term impact of parental migration for off-farm employment on children's schooling years.

The rest of this study is structured as follows: the next section describes the data and identification strategy used in our study. Section 3 presents our empirical results. The summary of findings and some

discussions are presented in the final section.

2. Data and identification strategy

2.1. Data

We used the China Rural Development Survey (CRDS) conducted by the Center for Chinese Agricultural Policy of the Chinese Academy of Sciences for our study. It was collected from four rounds of surveys which were conducted in the years 2005, 2008, 2012, and 2016. We collected employment information on all sampled individuals over 15 years old from 1998 to 2005 in first round of the survey. Then we collected information on those people between 2005 and 2007 in the second round of the survey, and so forth. As such, the data tracked employment information for all laborers in the sampled households for the 18 years following 1998.

The first round of the survey was conducted in April 2005. A multi-stage stratified sampling procedure is used to select the sample. The sample provinces were randomly selected from each of China's five major agro-ecological zones, not including Tibet, Hainan, Hong Kong, Macau, Taiwan, and four province-level municipalities (Beijing, Tianjin, Shanghai, and Chongqing). Those five sample provinces are Jiangsu, Sichuan, Shaanxi, Jilin, and Hebei. Then five sample counties were selected from each province by a two-step procedure. First, the enumeration team listed all counties in each province in descending order of per capita gross value of industrial output (GVIO). GVIO was used based on the conclusions of Rozelle (1996) that GVIO is a good predictor of standard of living and development potential and is often more reliable than net rural per capita income statistics. Second, the five sample counties were randomly selected from each list. After the county selection was completed, the team then chose the sample townships and villages following the same procedure outlined above. Finally, a nationally representative sample of 100 villages (5 provinces × 5 counties × 2 townships × 2 villages) was selected for this study. The survey team then used village rosters and the survey team's own count of households that were living in the village but not on the roster to randomly choose 20 households in each village. So, CRDS is not a simple random sample from the population. One of the key features of this design is that individuals are oversampled in some provinces and undersampled in some other provinces. Samples in each province would be either under or over represented within the analysis if weights are not applied. A weight-based upon the population size of each province is applied in all parts of the analysis in this study.

In these sample households, we investigated all family members, including children[2] who had gone to school in other cities or provinces and children who had separated from the original family due to marriage or employment. This was mainly through two ways: if these family members at home were familiar with the information concerning separated family members, we just investigated them and checked it by calling these separated family members. Otherwise, we interviewed by telephone at the time of the survey if the family members are not familiar with the information about their separated family members when the enumerator was still at the scene of the survey. More importantly, this survey tracks at least three generations of family members for each household: the household head and spouse (2nd generation), their parents (1st generation), and their children (3rd generation); or the household head and spouse (1st generation), their children (2nd generation), and their grandchildren (3rd generation).

Therefore, a family has two sets of distinct parent-child pairs: parent-child and child-grandchild. Instead of making a separate category for child-grandchild pairs, we simply relabel child-grandchild pairs as parent-child and pool them with the original parent-child pairs to conduct our analysis all at once. This allows us to take advantage of our survey and use the FFE model. See Fig. 1 for a typical example. It briefly portrays parent-child relationships within the family. In this example family, there are 5 pairs of parent-child relationships. They are: parent-child 1, parent-child 2, child 1-grandchild 1, child 1-grandchild 2, and child 2-grandchild 3. Variables such as parental schooling and the number of siblings may vary across individuals in different pairs of parent-child relationships; they would not be same for all the children of different generations in a family. For example, parent, child 1, and child 2 likely have different schooling years. Child 1, child 2, and grandchildren 1–3 account for the entire sample of "children" in this study. Similarly, parent, child 1, and child 2 account for all sampled "parents" in this study. As there are several pairs of parents in a family, we can calculate our estimate in the case where there are parent-child relationships of more than two generations in a family. To our knowledge, there are no other studies that have collected similar detailed personal information about extended family members over time in rural China.

We collected the personal characteristics of all family members, such as gender, schooling years, birth year, and so on. In the survey, we coded individuals and relationships in the family which enabled us to match children and their parents conveniently. Then we restricted the samples to those who entered elementary school after the year of 1998, which is the earliest year we could track the employment information of their parents. Finally, we get a sample which contains complete information for children themselves and their parents.

2.2. Identification strategy

In this paper, we adopt two methods to estimate the effect of parents' accumulated years of migration for off-farm employment on their children's schooling years during the elementary and junior high school education stages in rural China. These are the OLS and FFE methods, which are discussed below in detail.

2.2.1. The OLS model

As the benchmark estimation, we first use the OLS model. For convenience, we define *Edu* as the schooling years of the children. $Migrant_{dad}$ and $Migrant_{mom}$ represent the father's and mother's accumulated years of migration for off-farm employment during the child's elementary or junior high school education stages, respectively. In this study, we define the father/mother as a migrant if the number of months he/she is
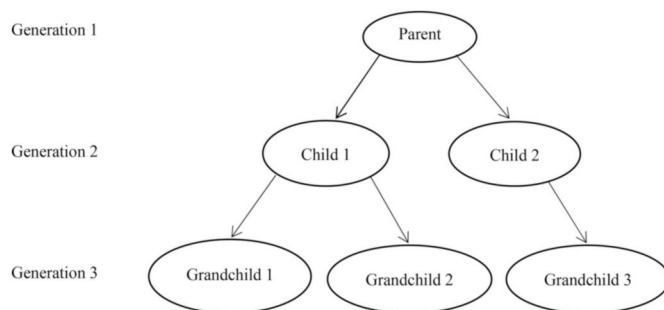
Fig. 1. A simplified family tree in the case of three generations.

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[2] As for the definition of children, it can be defined as follows: the direct biological off-spring of both parents who have finished their schooling and are >16 years old at the time of interviewing. It is possible that the current level of education is not the final level of education, and it should further be noted that the schooling of individuals in rural China rarely increases once the individual leaves school.

away from home is more than 6 months in each year.[3] So left-behind children are defined as at least one of their parents who had been away from home more than 6 months in each year. Then we count the accumulated years the father/mother was a migrant during their child's elementary or junior high school, in other words, the accumulated years of child was left-behind. $Migrant_{dad}$ and $Migrant_{mom}$ are variables which take value of 0–6 and 0–3 for the elementary and junior high school education stages, respectively. Z represents other factors which may influence the child's schooling years. These factors include: a set of dummy variables for male and non-Han ethnicity, each with a value of 1 if the child has that characteristic and 0 otherwise; a set of provincial dummies to capture regional factors that might affect the child's years of schooling; father's schooling years and mother's schooling years. Finally, we clustered the standard errors at the village level, allowing for correlation of households' influence on each other within the village.

We employ three empirical specifications to examine parents' migration experiences on the schooling years of their children. For each child i in household h, we have:

$$Edu_{ih} = \alpha + \beta Migrant_{dad_{ih}} + \rho Z_{ih} + \varepsilon_{ih} \tag{1}$$

$$Edu_{ih} = \alpha + \delta Migrant_{mom_{ih}} + \rho Z_{ih} + \varepsilon_{ih} \tag{2}$$

$$Edu_{ih} = \alpha + \beta Migrant_{dad_{ih}} + \delta Migrant_{mom_{ih}} + \rho Z_{ih} + \varepsilon_{ih} \tag{3}$$

where Edu is the schooling of the child which is measured by the number of schooling years. β and δ are the coefficients of interest that capture the effect of parents' migration experiences on their child's schooling years. α is the constant term. ρ is the effect of other factors, including: being male, being non-Han, the provincial dummy, and the parents' schooling years. ε is the error term.

2.2.2. The FFE model

A potential problem facing the OLS estimation is the endogeneity. In this study, it arises when parents' decision to migrate for off-farm employment and their child's schooling are both affected by some common factors, like similar genetics, family culture, and so on. For those parents who possess genetic characteristics of aggressiveness and struggle, they may have a higher probability to migrate for off-farm employment. Their child may also achieve more schooling just because of intergenerational transmission of genes. Many previous studies have shown that connection of similar genetics between parents and their children would bias results of empirical studies, in other words, more able fathers migrate and their more able children are more likely to stay in school and reach higher levels of schooling (Antman, 2012; Meng and Yamauchi, 2017). This connection between the parents' migration for off-farm employment and the schooling of their children may bias the results in a way which tends to overestimate the effect of the parents' migration on the children's schooling.

In order to address the potential endogeneity as much as possible, we furtherly use the FFE model to estimate the effect of the father's and mother's accumulated years of migration for off-farm employment during their children's elementary or junior high school education stages on the schooling of children, while eliminating these other contributing factors which have effects on both parental migration and their children's schooling. We do so by taking advantage of our survey in which we gathered data on three generations within the same family. The schooling of parents within the same family usually varies from one another. This allows us to make different pairings of each parent with each child within the same family.

Due to the potential problem of endogeneity and the unique sample characteristics of our survey, we employ the FFE model to estimate.

Despite these advantages, there remain some disadvantages to using the FFE model. Particularly, the model assumes that children within the same family have identical family culture and genetics. This is not strictly the case.

In the FFE model, for each child i in household h, we have:

$$Edu_{ih} = \alpha + \beta Migrant_{dad_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{4}$$

$$Edu_{ih} = \alpha + \delta Migrant_{mom_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{5}$$

$$Edu_{ih} = \alpha + \beta Migrant_{dad_{ih}} + \delta Migrant_{mom_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{6}$$

The definitions of α, β, and δ are the same as in the OLS model. ε is the error term. As mentioned above, OLS regression ignores the unobservable characteristics ν_h shared in each family, like genetics, which both have an impact on the parents' decision to migrate for off-farm employment and the schooling of children. By using the FFE estimation method, we can eliminate ν_h from the equation by differencing the equation above in the following way:

$$Edu_{ih} - \overline{Edu_h} = \beta\left(Migrant_{dad_{ih}} - \overline{Migrant_{dad_h}}\right) + \rho\left(Z_{ih} - \overline{Z_h}\right) + (\nu_h - \nu_h)$$
$$+ (\varepsilon_{ih} - \overline{\varepsilon_h}) \tag{7}$$

$$Edu_{ih} - \overline{Edu_h} = \delta\left(Migrant_{mom_{ih}} - \overline{Migrant_{mom_h}}\right) + \rho\left(Z_{ih} - \overline{Z_h}\right) + (\nu_h - \nu_h)$$
$$+ (\varepsilon_{ih} - \overline{\varepsilon_h}) \tag{8}$$

$$Edu_{ih} - \overline{Edu_h} = \beta\left(Migrant_{dad_{ih}} - \overline{Migrant_{dad_h}}\right) + \delta\left(Migrant_{mom_{ih}} - \overline{Migrant_{mom_h}}\right) +$$
$$\rho\left(Z_{ih} - \overline{Z_h}\right)$$
$$+ (\nu_h - \nu_h) + (\varepsilon_{ih} - \overline{\varepsilon_h}) \tag{9}$$

Where "$\overline{}$" indicates the average of each variable in each family. In this way, we can eliminate the impact of unobservable characteristics on the empirical results as much as possible and partially address the problem of endogeneity.

3. Results

3.1. Descriptive statistics of parents' migration experiences and their children's schooling years

The analysis of this study is conducted in two separate sub-samples, as shown above. The first contains sample children for whom we could gather information about their father's and mother's accumulated years of migration for off-farm employment while the child was in elementary school (the "elementary school stage" sub-sample). This sample contains these children who enrolled in elementary school between 1998 and 2009[4]; as of 2015, they had graduated and would never go back to school. Children still in school in the year of 2015 are excluded from the sample, though they enrolled in elementary school between 1998 and 2009. In China, every opportunity to enter higher education is almost exclusively in the form of examinations except for compulsory education. High school and college entrance examinations are extremely competitive in particular. In the samples of this study, none of them have an experience of school interruption and enter higher education after it.

The second sub-sample contains children for whom could gather information about their father's and mother's accumulated years of migration for off-farm employment while the child was in junior high school (the "junior high school stage" sub-sample). This sample contains

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[3] In fact, most migrant workers just return to their hometowns for a short time. The duration of the return is maybe one or two weeks during the Chinese Spring Festival which is the most important yearly holiday in China.

[4] Elementary school in China lasts 6 years, while junior high school is 3 years.

these children who enrolled in junior high school between 1998 and 2012. Individuals in this sample had also graduated and would never go back to school from 2016 and beyond, which is similar to those in the first sample.

Table 1 reports descriptive statistics on children's basic personal characteristics, as well as characteristics of the fathers and mothers, including key information on accumulated years of migration for off-farm employment for these elementary and junior high school stage sub-samples.

For the elementary school stage sub-sample, preliminary statistical analysis of the data showed that the average age of sampled children is 21.19 years old (Table 1, row 1, column 1), with males accounting for 56% (row 3, column 1), and the average schooling of those children being 10.67 years, which is equivalent to the first year of senior high school (row 2, column 1). This means there were still many children dropping out of junior high school before completion. In the sub-sample used here, 21.54 per cent of children had not completed junior high school. These results are consistent with some previous studies which showed that students in rural China are dropping out of junior high school at troubling rates (Yi et al., 2012; Mo et al., 2013; Shi et al., 2015).

We then turn to present the personal characteristics of the parents. The average age of the fathers is 46.66 years (row 4, column 1), and the average schooling of the fathers is 7.64 years, which means they did not complete junior high school (row 5, column 1). The average accumulated years of migration for off-farm employment is 0.56 years (row 6, column 1). The mothers' average age is 45.42 years (row 7, column 1), the average schooling of the mothers is 6.12 years, which is equivalent to completion of elementary school and is much less than that of the fathers (row 8, column 1). The average accumulated years of migration for off-farm employment is 0.14 years, which is only 25% of the fathers' (row 9, column 1). This means that children have a much higher possibility of experiencing paternal absence rather than maternal absence. In general, the average schooling for parents is about 4 years less than that of their children. This implies that, alongside China's social and economic development during the period, the schooling years of children have achieved great progress.

For the junior high school stage sub-sample, descriptive statistical analysis showed that the average age of the sampled children is 24.59 years (Table 1, row 1, column 4), with males accounting for 53% (row 3, column 4), and the average schooling being 11.42 years, which means they had almost completed senior high school (row 2, column 4). To some extent, the personal characteristics of the parents in this sample are similar to those of the sample above. The average age of the fathers is 50.32 years (row 4, column 4), and their average schooling is 7.99 years

(row 5, column 4). The average accumulated years of migration for off-farm employment is 0.24 years (row 6, column 4). The mothers' average age is 48.97 years (row 7, column 4), their average schooling is 6.15 years (row 8, column 4), and the average accumulated years of migration for off-farm employment is 0.06 years (row 9, column 4).

Next, we conduct bivariate analyses on the impact of father's and mother's migration experiences on the schooling of their children. As a result, we depict the relationship of the father's and mother's accumulated years of migration for off-farm employment during their children's elementary school education stage and their children's schooling years in Fig. 2. It shows that the schooling of the children is 10.51 years if the
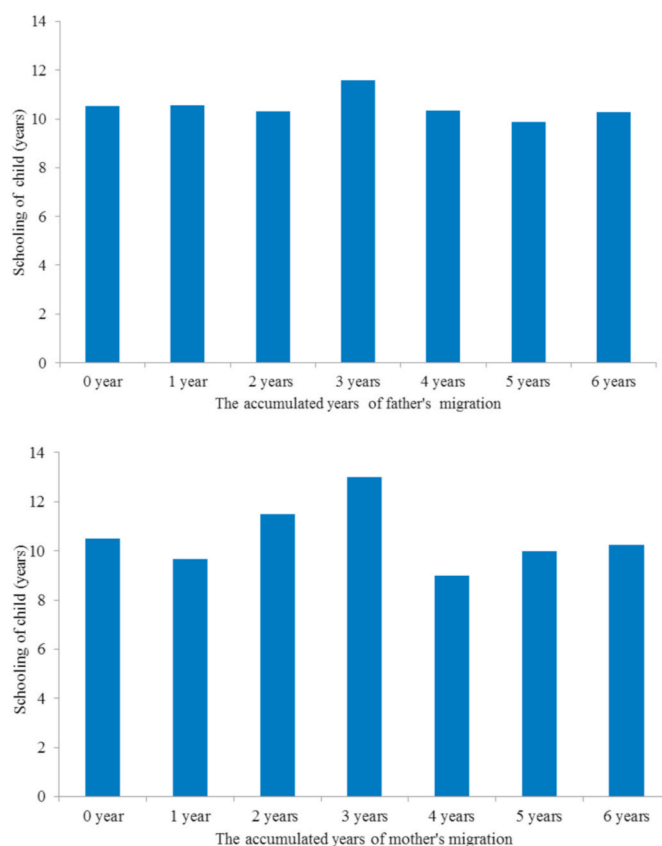
Fig. 2. Child's schooling years and its father's and mother's migration status during child's elementary school education stage.

Table 1
Descriptions of child's personal characteristics and parent's migration experiences during child's elementary and junior high school education stage.

		Elementary school stage sample			Junior high school stage sample		
		Mean	Std. Dev.	Sample size	Mean	Std. Dev	Sample size
		(1)	(2)	(3)	(4)	(5)	(6)
	The characteristics of children						
(1)	Age (years)	21.19	2.52	933	24.59	3.56	1922
(2)	Years of schooling	10.67	2.87	933	11.42	2.90	1922
(3)	Male (1 = yes)	0.56	0.50	933	0.53	0.50	1922
	The characteristics of father						
(4)	Age (years)	46.66	5.00	933	50.32	6.09	1922
(5)	Years of schooling	7.64	2.88	933	7.99	2.92	1922
(6)	Migrant experiences (years)	0.56	1.66	933	0.24	0.77	1922
	The characteristics of mother						
(7)	Age (years)	45.42	4.86	933	48.97	5.71	1922
(8)	Years of schooling	6.12	3.33	933	6.15	3.57	1922
(9)	Migrant experiences (years)	0.14	0.85	933	0.06	0.40	1922

Data source: Authors' survey.

father had no migration experiences during the child's elementary school education stage. When the father's accumulated years of migration for off-farm employment during their children's elementary school education stage increases from 1 year to 6 years, the schooling of the child is between 9.88 and 11.60 years. Moreover, the trend is ambiguous. The impact of the mother's migration experiences on their children's schooling years is similar to that of the father's.

The relationship of the father's and mother's accumulated years of migration for off-farm employment during children's junior high school education stage and children's schooling years is presented in Fig. 3. It shows that the schooling of children is 11.29 years if the father has no migration experiences during the child's junior high school stage. When the father's accumulated years of migration for off-farm employment during their children's junior high school education stage increases from 1 year to 3 years, the schooling years of children is between 11.15 and 11.75 years. The difference between the four groups seems to be minute. It also shows that the schooling of children is 11.3 years if the mother has no migration experiences during the child's junior high school education stage. With an increase in the mother's accumulated years of migration, the schooling years of the children has a slight increase.

F-test result of bivariate analyses is presented in Table 2. It shows that there is no significant difference across different categories though the difference between the last two categories is close to statistically significant.

Considering that the above descriptive results are just preliminary judgments which have not considered the influence of other control variables, let alone endogenous problems. The impact of parental migration for off-farm employment on the schooling years of their children needs further empirical analysis.

Table 2

F-test result of bivariate analyses of the effect of parents' migration on their child's schooling years.

| | | F-test |
		(1)
(1)	Father's migration during child's elementary school education stage on child's schooling years	0.21
(2)	Mother's migration during child's elementary school education stage on child's schooling years	0.03
(3)	Father's migration during child's junior high school education stage on child's schooling years	2.41
(4)	Mother's migration during child's junior high school education stage on child's schooling years	1.96

Data source: Authors' survey.

3.2. Results of the OLS estimation

Based on the above descriptive analysis, we then use the OLS method to estimate the effect of parental migration on the schooling years of their children. The estimation results show that the accumulated years of fathers' or mothers' labor migration during their children's elementary school education stage have a overall negative yet insignificant effect on their children's schooling years (Table 3). We first investigate the effect of father's and mother's separately, and it shows that the labor migration experiences of parents has no effect on the schooling years of their children (row 1, column 1; row 2, column 2).

However, the results of other control variables suggest some interesting conclusions. Male children have approximately 0.68 fewer years of schooling years than female children (row 5, columns 1–3). This may show the change in the gender pattern given China's special background, and it is also confirmed by the fact that the proportion of females among undergraduates has exceeded 55.90 per cent in recent years (National Bureau of Statistics of People's Republic of China, 2016). The implementation of the One-Child Policy (OCP) in China from 1979 to 2015 may explain this outcome. Since these parents who have no sons do not have opportunity to discriminate based on the child's gender; as such, they have to invest in their daughters if they have no sons. This may show a new characteristic of schooling years between male and female children as males' advantages in schooling years are gradually replaced by females. Meanwhile, the empirical results show that father's and mother's schooling years have a positive effect on their child's schooling years (row 7, column 1; row 8, column 2). This finding is consistent with previous studies (Behrman and Rosenzweig, 2002; Björklund et al., 2006; Oreopoulos, Page, and Stevens, 2006; Holmlund, Lindahl, and Plug, 2011; Pronzato, 2012; Dong et al., 2019).

When both fathers' and mothers' migration information are included in the model, the estimation results are consistent with the aforementioned results. The accumulated years of parental migration still have no effect on the schooling years of the children (rows 1 and 2, column 3).

We now turn to these sample children for whom we could obtain full information on the accumulated years of the fathers' or mothers' labor migration during the child's junior high school education stage. The results of the estimation are slightly varied from the results above. It shows that the accumulated years of the fathers' labor migration during the child's junior high school education stage has a positive effect on schooling years (row 3, column 4). However, the accumulated years of mothers' labor migration during the child's junior high school education stage has a positive yet insignificant effect on schooling years (row 4, column 5). The results of other control variables also attract attention. They show that male children receive approximately 0.42 fewer years of education than females do (row 5, columns 4 and 5), which is relatively lower than in the results estimated above for the elementary school stage sample. The fathers' and mothers' education have a positive effect on the child's schooling years, which is consistent with the results of
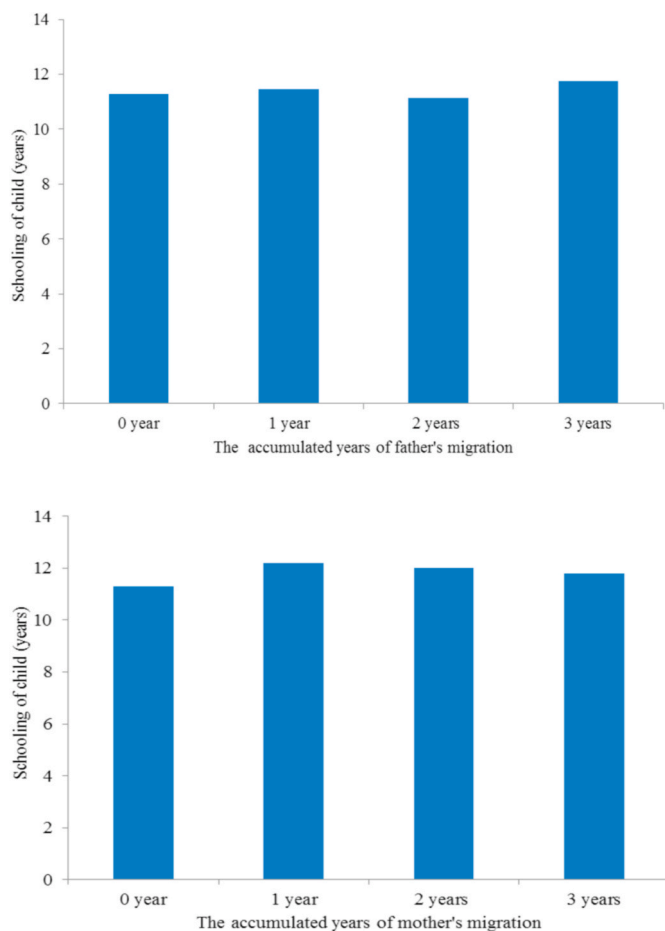

Fig. 3. Child's schooling years and its father's and mother's migration status during child's junior high school education stage.

Table 3
The effect of parents' migration on their child's schooling years: Results from OLS estimation.

	Explanatory variables	Child's schooling years					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	The accumulated years of father's migration during child's elementary school education stage	0.003 (0.057)		−0.002 (0.056)			
(2)	The accumulated years of mother's migration during child's elementary school education stage		−0.025 (0.146)	−0.013 (0.132)			
(3)	The accumulated years of father's migration during child's junior high school education stage				0.196* (0.087)		0.152 (0.090)
(4)	The accumulated years of mother's migration during child's junior high school education stage					0.226 (0.180)	0.170 (0.172)
(5)	Male (1 = yes)	−0.663*** (0.186)	−0.701*** (0.182)	−0.686*** (0.179)	−0.432** (0.136)	−0.417** (0.136)	−0.417** (0.133)
(6)	Age	0.300*** (0.033)	0.320*** (0.033)	0.322*** (0.033)	0.108*** (0.018)	0.126*** (0.018)	0.120*** (0.017)
(7)	Father's schooling	0.242*** (0.032)		0.171*** (0.032)	0.242*** (0.023)		0.186*** (0.024)
(8)	Mother's schooling		0.262*** (0.027)	0.222*** (0.028)		0.193*** (0.020)	0.146*** (0.021)
(9)	Non-Han (1 = yes)	−0.189 (0.564)	0.081 (0.570)	−0.143 (0.564)	−0.403 (0.385)	−0.108 (0.388)	−0.311 (0.381)
(10)	Provincial dummy	included	included	included	included	included	included
(11)	Constant	3.696*** (0.815)	3.659*** (0.790)	2.362** (0.810)	7.645*** (0.517)	8.096*** (0.496)	6.848*** (0.522)
(12)	Observations	933	933	933	1922	1922	1922
(13)	R-squared	0.198	0.231	0.257	0.122	0.120	0.151

Data source: Authors' survey.
Notes: Robust standard errors in parentheses, ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

elementary school stage sample (row 7, column 4; row 8, column 5). When both the father and mother are included in the model, the estimation results are still consistent with the aforementioned results (column 6).

3.3. Results of the FFE estimation

We use the FFE method to deal with potential endogeneity problems caused by factors such as genetics and family culture on the estimation results. This helps obtain a more reasonable estimation of the impact of the accumulated years of the fathers' migration for off-farm employment during the child's elementary and junior high school education stages on child schooling years (Table 4). Overall, there is consistency between the FFE and the OLS estimation results to some extent, but there still exist some differences between them.

For the elementary school sub-sample, the results estimated by the FFE method are similar to those of the OLS method (row 1, columns 1 and 3; row 2, columns 2 and 3). As for the junior high school sub-sample, the results from the FFE estimation, unlike those of the OLS estimation, show that the accumulated years of fathers' migration for off-farm employment during their children's junior high school education stage has no effect on the child's schooling years (row 3, columns 4 and 6).

Table 4
The effect of parents' migration on their child's schooling years: Results from FFE estimation.

	Explanatory variables	Child's schooling years					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	The accumulated years of father's migration during child's elementary school education stage	0.020 (0.112)		0.031 (0.122)			
(2)	The accumulated years of mother's migration during child's elementary school education stage		−0.078 (0.225)	−0.100 (0.193)			
(3)	The accumulated years of father's migration during child's junior high school education stage				0.229 (0.178)		0.190 (0.193)
(4)	The accumulated years of mother's migration during child's junior high school education stage					0.352 (0.302)	0.254 (0.284)
(5)	Male (1 = yes)	−0.756** (0.283)	−0.854** (0.292)	−0.778** (0.281)	−0.432* (0.191)	−0.428* (0.192)	−0.423* (0.190)
(6)	Age	0.156** (0.056)	0.154** (0.057)	0.167** (0.055)	0.070 (0.036)	0.068 (0.037)	0.071 (0.037)
(7)	Father's schooling	0.255** (0.083)		0.260** (0.082)	0.150* (0.061)		0.144* (0.063)
(8)	Mother's schooling		0.124 (0.070)	0.134 (0.070)		0.037 (0.047)	0.026 (0.051)
(9)	Non-Han (1 = yes)	−1.480*** (0.382)	−1.156 (0.609)	−0.371 (0.668)	−1.702* (0.687)	−1.875* (0.756)	−1.707* (0.718)
(10)	Constant	5.858*** (1.255)	7.167*** (1.392)	4.771** (1.452)	8.701*** (1.034)	9.764*** (1.017)	8.566*** (1.084)
(11)	Observations	933	933	933	1922	1922	1922
(12)	R-squared	0.130	0.089	0.144	0.035	0.024	0.037
(13)	Number of households	684	684	684	1186	1186	1186

Data source: Authors' survey.
Notes: Robust standard errors in parentheses, ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

The results for the mothers are consistent with the OLS estimation. This may reflect that the common factors which affect both the parents' behavior concerning migration and the schooling years of children have biased the estimation results. They tend to overestimate the effect of parental migration on the schooling years of children if we ignore the endogeneity. However, current literature does not adequately explain these findings, and further investigation is required.

Appendix Table 1 presents the heterogeneous effect of parental migration. To conduct this test, we have broken sample households into five types: never migrated households, farther migrated only households, mother migrated only households, two parents taking turns migrated households, and both parents migrated households. Using never migrated households as the benchmark group for comparison, we employ the FFE method to investigate the cumulative impact of parental migration on the schooling of the child. The results show that most of the coefficients of the accumulated years of parent's migration during a child's elementary school education stage on the schooling of the child are negative, however, they are statistically insignificant. In other words, results show that parental migration has no heterogeneous effect on the schooling of the child.

It is clear that the sample used in this study is multilevel data since individuals could be divided into groups that share something in common. Children from the same households may similarly have low or high schooling due to parents' value on education. Similarly, children in the same village may have similar schooling due to village culture and other village-level factors, such as access to schools. To investigate its impact on the empirical results of this study, a multilevel mixed-effects estimation has been employed as a robustness check in this part. Appendix Table 2 reports the results estimated by using the multilevel mixed-effects method. It shows that the accumulated years of the father's or mother's migration for off-farm employment during the child's elementary or junior high school education stage have no impact on the schooling of their child. The results of the estimation are consistent with the results of the FFE estimation.

3.4. Further tests and robust checks

3.4.1. The influence of parents' migration for off-farm employment during the child's compulsory education and entire education stage

The analysis above merely examined the effects of the accumulated years of fathers' or mothers' migration for off-farm employment during the child's elementary or junior high school education stages on child's schooling years. However, parents who migrated during their child's junior high school years may also have migrated when their children were in elementary school; would the prior migration history have an impact on the empirical results above? If the answer is yes, the results above would be biased. We also need to consider the importance of the compulsory education stage as a whole in the overall education phase of a person. This section examines the effect of the accumulated years of fathers' or mothers' migration for off-farm employment during the children's compulsory education stage on child schooling years. With the implementation of the Compulsory Education Law in 1986, the minimum number of years children must stay in school became 9 years, from the first year of elementary school to the third year of junior high school. Appendix Table 3 describes the basic statistical analysis of the sample.

Table 5 reports the results estimated by using the OLS and FFE methods. The results of the OLS estimation show that the accumulated years of the fathers' or mothers' migration for off-farm employment during the child's compulsory education stage does not affect schooling years of children (row 1, column 1; row 2, column 2). Furthermore, including both the migration experiences of fathers and mothers in the regression equation, the results still show its robustness (rows 1 and 2, column 3).

We also use the FFE estimation method to help alleviate endogeneity problems due to sharing of genetic and family culture by parents and their children in this section. The empirical analysis shows that the father's or mother's accumulated years of migration for off-farm employment during their children's compulsory school education stage has no effect on the schooling years of their children (Table 5, columns 4–6).

Considering the first 9-year period is compulsory, in theory, children will attend schools and complete middle school regardless parental migration or not. However, high school is optional and the absence of parents due to migration may have a more direct and significant impact on children's schooling years. Thus, we furtherly include the entire school educational period to conduct a test. The results are presented in Appendix Table 4. It shows that accumulated years of the fathers' or mothers' migration for off-farm employment during the child's entire education stage does not affect the schooling years of children (row 1,

Table 5

The effect of parents' migration experiences during child's compulsory school education stage on their child's schooling years: Results from OLS and FFE estimation.

		Child's schooling years					
		OLS			FFE		
	Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
(1)	The accumulated years of father's migration during child's compulsory education stage	0.041 (0.039)		0.031 (0.039)	0.020 (0.076)		0.022 (0.084)
(2)	The accumulated years of mother's migration during child's compulsory education stage		0.058 (0.087)	0.033 (0.084)		0.022 (0.147)	−0.025 (0.148)
(3)	Male (1 = yes)	−0.820*** (0.183)	−0.837*** (0.179)	−0.834*** (0.177)	−0.877** (0.300)	−0.927** (0.303)	−0.910** (0.295)
(4)	Age	0.328*** (0.035)	0.345*** (0.034)	0.347*** (0.034)	0.229** (0.072)	0.227** (0.073)	0.230** (0.071)
(5)	Father's schooling	0.213*** (0.030)		0.150*** (0.030)	0.202* (0.093)		0.209* (0.096)
(6)	Mother's schooling		0.236*** (0.026)	0.202*** (0.027)		0.097 (0.075)	0.109 (0.074)
(7)	Non-Han (1 = yes)	−0.577 (0.564)	−0.338 (0.564)	−0.510 (0.560)	−1.517*** (0.426)	−1.298* (0.661)	−0.595 (0.717)
(8)	Provincial dummy	included	included	included	–	–	–
(9)	Constant	3.564*** (0.821)	3.530*** (0.787)	2.331** (0.809)	5.045** (1.569)	6.076*** (1.701)	4.300* (1.691)
(10)	Observations	859	859	859	859	859	859
(11)	R-squared	0.206	0.239	0.261	0.149	0.125	0.158
(12)	Number of households	646	646	646	646	646	646

Data source: Authors' survey.

Notes: Robust standard errors in parentheses, ***p < 0.001, **p < 0.01, *p < 0.05.

column 1; row 2, column 2). Furthermore, including both the migration experiences of fathers and mothers in the regression equation, the results still show its robustness (rows 1 and 2, column 3). However, results estimated by the FFE method shows that accumulated years of the fathers' or mothers' migration for off-farm employment during the child's entire education stage may have a positive effect on the schooling years of children though it is not robust enough (rows 1, columns 4 and 6; row 2, columns 5 and 6).

3.4.2. *The influence of whether parents migrated during the child's education stage on child schooling years*

As a robustness check, we further investigate the effect of whether parents had ever migrated during child's elementary or junior high school education on their schooling years. A value of one for the father's new dummy variable indicates that he had migrated during child's elementary or junior high school education stages, and zero otherwise. This is the same for the mother's new dummy variable. A value of one for both indicates that the pair had migrated during child's elementary or junior high school education stages, and zero for either indicates that the pair had not. The addition of these dummy variables, therefore, gives us six more equations for our robustness checks: one each for the father's, mother's, and the combined parents' status of having migrated during children's elementary or junior high school education stages.

Table 6 reports the results estimated by using the FFE method. It shows that the father or mother ever having migrated during child's elementary or junior high school has no effect on the child's schooling years. The results of the estimation in this section are consistent with the results of the FFE estimation in Section 3.3.

3.4.3. *The influence of parents' migration experiences during the child's education on the decision to attend high school*

The results above show that we could scarcely find an impact of the parents' migration experiences on the schooling years of children. Is this outcome caused by the distribution of the schooling years of children? For instance, though the accumulated years of parents' migration for off-farm employment has no impact on the child's schooling years, could it increase the probability of the child attending high school? We thus investigate the effect of parents' accumulated years of migration during

the child's elementary or junior high school education stages on their decision to enroll in high school.

We employ the FFE estimation method to investigate the impact of parents' migration for off-farm employment on their children's decision to attend high school. The empirical equations in this section take the form:

$$High_{ih} = \alpha + \beta Mig_{dad_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{10}$$

$$High_{ih} = \alpha + \delta Mig_{mom_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{11}$$

$$High_{ih} = \alpha + \beta Mig_{dad_{ih}} + \delta Mig_{mom_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{12}$$

where $High_{ih}$ is a dummy variable which equals 1 if the child has achieved an education level of high school or above, and zero otherwise. We use a linear probability model and family fixed effects (LPM-FFE) to conduct the analysis in this part due to the binary characteristics of the explained variables and alleviate the endogeneity problems as much as possible. The definitions of the other variables are the same as previously defined. β and δ are the coefficients of interest that capture the effect of parents' migration experiences on their child's schooling years.

Table 7 reports the results estimated by using the LPM-FFE method. It shows that the accumulated years of the father's or mother's migration have no impact on the child's probability of achieving education of high school or above. The results of the estimation in this section are consistent with the results of the FFE estimation in Section 3.3.

We have investigated the impact of the timing of parental migration on child's decision to attend high school furtherly. In particular, we examine the heterogeneous effect of parental migration during their child's junior school stage on their probability to attend high school. The results still hold when we examine different types of migrant households (Appendix Table 5).

3.5. *The impact of parents' migration for off-farm employment on child educational investment*

The results above all show that the accumulated years of parents' migration for off-farm employment during the child's elementary or junior high school education stages have no effect on the child's

Table 6
The effect of whether parents had ever migrated during child's elementary/junior high school education stage on their schooling years: Results from FFE estimation.

| | Explanatory variables | Child's schooling years | | | | | |
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Father had ever migrated during child's elementary school education stage (1 = yes)	0.388 (0.623)		0.589 (0.677)			
(2)	Mother had ever migrated during child's elementary school education stage (1 = yes)		−0.770 (1.184)	−1.190 (1.027)			
(3)	Father had ever migrated during child's junior high school education stage (1 = yes)				0.343 (0.510)		0.206 (0.544)
(4)	Mother had ever migrated during child's junior high school education stage (1 = yes)					1.112 −0.910	0.975 −0.854
(5)	Male (1 = yes)	−0.761** (0.282)	−0.857** (0.291)	−0.789** (0.281)	−0.431* (0.192)	−0.432* (0.192)	−0.423* (0.191)
(6)	Age	0.156** (0.057)	0.155** (0.057)	0.169** (0.056)	0.07 (0.036)	0.068 (0.037)	0.069 (0.037)
(7)	Father's schooling	0.254** (0.083)		0.260** (0.081)	0.152* (0.061)		0.147* (0.063)
(8)	Mother's schooling		0.126 (0.070)	0.131 (0.069)		0.037 (0.047)	0.023 (0.051)
(9)	Non-Han (1 = yes)	−1.477*** (0.383)	−1.133 (0.608)	−0.383 (0.656)	−1.700* (0.688)	−1.873* (0.757)	−1.706* (0.715)
(10)	Constant	5.833*** (1.278)	7.148*** (1.390)	4.726** (1.457)	8.714*** (1.034)	9.772*** (1.017)	8.619*** (1.084)
(11)	Observations	933	933	933	1922	1922	1922
(12)	R-squared	0.131	0.091	0.151	0.033	0.024	0.036
(13)	Number of households	684	684	684	1186	1186	1186

Data source: Authors' survey.
Notes: Robust standard errors in parentheses, ***p < 0.001, **p < 0.01, *p < 0.05.

Table 7
The effect of parents' migration experiences on their child's decision to attend high school: Results from LPM-FFE estimation.

	Explanatory variables	Child has achieved education of high school or above (1 = yes)					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	The accumulated years of father's migration during child's elementary school education stage	0.009 (0.021)		0.020 (0.025)			
(2)	The accumulated years of mother's migration during child's elementary school education stage		−0.030 (0.031)	−0.043 (0.031)			
(3)	The accumulated years of father's migration during child's junior high school education stage				0.024 (0.031)		0.019 (0.034)
(4)	The accumulated years of mother's migration during child's junior high school education stage					0.04 −0.045	0.029 −0.044
(5)	Male (1 = yes)	−0.077 (0.053)	−0.092 (0.056)	−0.082 (0.053)	−0.033 (0.035)	−0.033 (0.035)	−0.032 (0.035)
(6)	Age	0.029* (0.012)	0.028* (0.012)	0.031** (0.012)	0.000 (0.006)	−0.000 (0.006)	0.000 (0.006)
(7)	Father's schooling	0.044** (0.015)		0.044** (0.014)	0.023* (0.011)		0.023* (0.012)
(8)	Mother's schooling		0.016 (0.013)	0.017 (0.013)		0.002 (0.008)	0.0002 (0.009)
(9)	Non-Han (1 = yes)	−0.792*** (0.067)	−0.778*** (0.116)	−0.647*** (0.123)	−0.753*** (0.201)	−0.780*** (0.204)	−0.754*** (0.201)
(10)	Constant	−0.417 (0.266)	−0.163 (0.278)	−0.581* (0.285)	0.363* (0.177)	0.551** (0.176)	0.366* (0.185)
(11)	Observations	933	933	933	1922	1922	1922
(12)	R-squared	0.110	0.071	0.125	0.025	0.015	0.026
(13)	Number of households	684	684	684	1186	1186	1186

Data source: Authors' survey.
Notes: Robust standard errors in parentheses, ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

schooling years. If this is indeed the case, then uncovering the mechanism behind how this happens becomes important. In fact, the aforementioned empirical results concern the total effect of parents' migration on child schooling years. As mentioned above, the schooling years of these children is mostly affected in two ways. On the one hand, off-farm income brought home by parents could increase investment in the child's education. On the other hand, the lack of parental care may offset the positive effect of additional investment.

We investigate the impact of parents' migration for off-farm employment on their educational investment in their children using samples from two survey years. Due to data limitations, we are unable to investigate the impact of parents' migration for off-farm employment on the educational investment in their children for those samples in this study. This is simply because we have not collected historical information related to educational investment during the elementary/junior high education stages. Fortunately, we have collected information on educational investment in children in two waves of the survey, and this also ensures the quality of educational investment data considering the accuracy of recalling data. To accommodate this, we use these sampled children who attended school during 2007 and 2015.

We also employ the FFE estimation method to investigate the impact of parents' migration for off-farm employment on the educational investment in their children in this section. The empirical equations take the form:

$$Inv_{ih} = \alpha + \beta Mig_{dad_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{13}$$

$$Inv_{ih} = \alpha + \delta Mig_{mom_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{14}$$

$$Inv_{ih} = \alpha + \beta Mig_{dad_{ih}} + \delta Mig_{mom_{ih}} + \rho Z_{ih} + \nu_h + \varepsilon_{ih} \tag{15}$$

Where *Inv* is the logarithmic form of educational investment in the child which is measured by the Chinese yuan with a base year of 2000. *Mig* represent the accumulated years of parent's migration in the latest three years before the survey year and whether father/mother migrated in the year before the survey year, respectively. There are thus six equations in this section to account for these different measurements of the parents' migration. β and δ are the coefficients of interest that capture the effect of parents' migration experiences on educational investment in their child. α is the constant term. ρ is the effect of other factors, including: male, non-Han, the provincial dummy, and parents' schooling years. ε is the error term.

We focus on the effect of whether the father/mother migrated in the year before the survey year on the educational investment in the children first: namely, the contemporaneous effect. The results show that the fathers' migration for off-farm employment has a positive impact on educational investment (Table 8, row 1, column 1). However, mothers' migration for off-farm employment has no impact on educational investment (row 2, column 2). When both the fathers' and mothers' migration for off-farm employment are considered in the regression, the results show that fathers' migration for off-farm employment has a positive impact on educational investment while mothers' has no impact (rows 1 and 2, column 3). This is further supported by previous studies (Lloyd and Blanc, 1996; Bai et al., 2019; Huang et al., 2019). When we investigate the relatively longer accumulated effect of parents' migration for off-farm employment on their children's educational investment, the results show that fathers' migration for off-farm employment has a positive effect on the child's educational investment (row 3, columns 4 and 6; row 4, columns 5 and 6). This may be due to two reasons. The first is that fathers' migration for off-farm employment would strengthen the family's income to some extent (Bai et al., 2019). The second is that the mother/grandparent may dote on their grandchildren and invest more in them since the responsibility of guardianship falls on the mother/grandparent if father have migrated (Joshi, 2004; Huang et al., 2019).

4. Conclusion and discussion

In this study, we use data that tracked 18 years of employment history to estimate the impact of the accumulated years of father's or mother's migration for off-farm employment on their child's schooling years in rural China. By using the OLS and FFE estimation methods, this study concludes that the accumulated years of parents' migration for off-farm employment during the child's elementary or junior high school education stages have no negative effect on the children's schooling years. By using the FFE estimation method, we have also tried to address endogeneity issues to some extent.

Table 8

The effect of parents' migration experiences on their child's educational investment during child's compulsory school education stage: Results from FFE estimation.

	Explanatory variables	The loglikelihood of child's educational investment					
		One year			Three year		
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Father had migration in the last year of each survey	0.581** (0.248)		0.699*** (0.263)			
(2)	Mother had migration in the last year of each survey		−0.108 (0.376)	−0.533 (0.398)			
(3)	The accumulated years of father's migration during the last three years of each survey				0.226** (0.090)		0.251*** (0.094)
(4)	The accumulated years of mother's migration during the last three years of each survey					0.009 (0.132)	−0.125 (0.138)
(5)	Male (1 = yes)	0.296*** (0.109)	0.309*** (0.110)	0.302*** (0.109)	0.299*** (0.108)	0.306*** (0.110)	0.305*** (0.109)
(6)	Age	0.263*** (0.014)	0.265*** (0.015)	0.263*** (0.014)	0.263*** (0.014)	0.265*** (0.015)	0.263*** (0.014)
(7)	Father's schooling	0.108* (0.061)		0.116* (0.062)	0.109* (0.061)		0.114* (0.062)
(8)	Mother's schooling		0.030 (0.070)	0.010 (0.070)		0.031 (0.070)	0.016 (0.070)
(9)	Non-Han (1 = yes)	−1.171* (0.674)	−1.108 (0.674)	−1.135* (0.673)	−1.176* (0.675)	−0.784 (0.633)	−0.822 (0.633)
(10)	Constant	3.003*** (0.537)	3.750*** (0.532)	2.876*** (0.694)	2.985*** (0.537)	3.738*** (0.531)	2.827*** (0.696)
(11)	Observations	1453	1453	1453	1453	1453	1453
(12)	R-squared	0.420	0.410	0.422	0.421	0.410	0.422
(13)	Number of households	960	960	960	960	960	960

Data source: Authors' survey.

Notes: Educational investment is measured in 2000 Chinese yuan. Robust standard errors in parentheses, ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$..

Results of this study stand up to several robustness checks. However, our results could be biased if the assumptions are untenable. Some factors that contribute to the decision of parent's migration are not observable for researchers. For example, those parents who believe that the schooling years of their children would suffer decided not to migrate while those that believed their children's schooling years would not suffer decided to migrate. Meanwhile, there exist other potential biases. Would the results of this study invalid if there is a selection bias that we did not account for? It is difficult to judge. A previous study shows that even if there was a such selection bias, the academic performance of children does not suffer when their parents out-migrate to seek off-farm employment (Bai et al., 2018). Though it may not provide enough evidence that the sample of this study is also free of selection bias or estimation bias risk. At least it shows the impact of selection bias is not as serious as expected.

In fact, even if the absence of parental guardianship may hurt children's schooling performance in the short run, there exists a buffer effect, such as increased investment in their education. In general, the results show that parents' migration for off-farm employment has a positive effect on educational investment in the child. Remittances sent back by parents could provide the necessary budget support for left-behind children (Antman, 2012; Ambler et al., 2015). There may be other positive effects which could offset the absence of guardianship and parental care. Parents who migrate for off-farm employment are more likely to be exposed to information and opportunities, and they may have improved their expectations for returns to education, thus helping rural left-behind children to recognize the importance of achieving a good education themselves (Batista et al., 2007). Another possible positive effect is that these parents who migrated to urban areas or cities may receive advanced educational concepts and learning guidance materials, and send them to their children (Shi and Zhao, 2016).

However, the result that even though parental migration significantly increased investment in child education, it did not significantly improve child's schooling years, is an indicator that the economic benefits brought by migration are not working well. The average years of schooling of left-behind children are 10.97, which is merely slightly higher than the 9-year compulsory education. This is also a sign that left-behind children's education is far behind the national average.

Thus, results of this study don't mean our study provides an empirical basis for ignoring the educational needs of left-behind children from a policy perspective. On the one hand, when the negative effect of the absence of parental guardianship arises and could be alleviated effectively, the effect of parents' migration on the child's schooling years may be made positive. On the other hand, these left-behind children may suffer negative impacts in terms of other perspectives of well-being, mental health, and so forth. Many studies discuss the impact of parental migration on the subjective well-being/mental health of rural children in the short run and have not gotten a clear conclusion on this question. Some studies show that parental migration damages the subjective well-being/mental health of rural children (Jia and Tian, 2010; Lee and Park, 2010; Su et al., 2013; Shi et al., 2016; Liu et al., 2017). Other studies show that parental migration has no impact on the subjective well-being/mental health of rural children (Xu and Xie, 2015; Wang et al., 2019). Moreover, these studies are still lacking a perspective of the long-term. This may be an important topic that needs to be focused on in the future.

Therefore, in terms of policy implications, maybe we should divert attention to other aspects and support children in a more comprehensive way, rather than just focusing on the impact of parents' migration for off-farm employment on their academic performance or schooling years. As such, policy makers may be better off paying attention to mental health, well-being, and other indicators surrounding left-behind children. By taking advantage of the positive effect of the educational investment and alleviating the negative effect of lack of guardianship, the government may ensure long-term human capital improvements in rural areas. In this way, China could promote achieving sustainable growth and development in the future.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrurstud.2021.07.007.

Author statement

The authors declared that they have no conflicts of interest to this work. We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the manuscript submitted. We would like to confirm that this manuscript has not been published, nor is it being considered for publication elsewhere. We will make sure that all of the other co-authors are kept informed as to the progress of the review.

Appendix Table 1
The heterogeneous effects of parents' migration on their child's schooling years: Results from FFE estimation

	Explanatory variables	Child's schooling years							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	The accumulated years of both parent's migration during child's elementary school education stage	0.985 (1.547)							
(2)	The accumulated years of one parent's migration during child's elementary school education stage (father or mother stay at home)		−0.724 (0.846)						
(3)	The accumulated years of father's migration during child's elementary school education stage (mother stay at home)			−0.368 (0.834)					
(4)	The accumulated years of mother's migration during child's elmentary school education stage (father stay at home)				−3.250 (2.731)				
(5)	The accumulated years of both parent's migration during child's junior school education stage					0.619 (1.205)			
(6)	The accumulated years of one parent's migration during child's junior school education stage (fathor or mother stay at home)						0.672 (0.604)		
(7)	The accumulated years of father's migration during child's junior high school education stage (mother stay at home)							0.450 (0.706)	
(8)	The accumulated years of mother's migration during child's junior high school education stage (father stay at home)								1.103 (1.242)
(9)	Male (1 = yes)	−0.792** (0.296)	−0.560* (0.270)	−0.589* (0.273)	−0.601* (0.294)	−0.435* (0.201)	−0.349 (0.190)	−0.355 (0.190)	−0.389* (0.196)
(10)	Age	0.117 (0.063)	0.169** (0.060)	0.187** (0.060)	0.134* (0.061)	0.045 (0.037)	0.063 (0.037)	0.061 (0.037)	0.052 (0.037)
(11)	Father's schooling	0.184 (0.098)	0.221* (0.095)	0.200* (0.094)	0.126 (0.097)	0.056 (0.066)	0.084 (0.064)	0.063 (0.065)	0.060 (0.068)
(12)	Mother's schooling	0.116 (0.071)	0.112 (0.073)	0.125 (0.072)	0.122 (0.069)	0.074 (0.053)	0.050 (0.048)	0.043 (0.050)	0.077 (0.052)
(13)	Non-Han (1 = yes)	−0.726 (0.681)	−0.884 (0.713)	−0.808 (0.712)	−1.048 (0.660)	−1.810* (0.862)	−1.823* (0.768)	−1.848* (0.765)	−1.827* (0.843)
(14)	Constant	6.528*** (1.653)	5.110*** (1.527)	4.786** (1.537)	6.522*** (1.604)	9.629*** (1.079)	9.085*** (1.074)	9.346*** (1.067)	9.380*** (1.084)
(15)	Observations	830	877	868	831	1745	1844	1828	1747
(16)	R-squared	0.112	0.118	0.121	0.089	0.023	0.025	0.020	0.026
(17)	Number of households	620	649	644	622	1098	1157	1150	1098

Data source: Authors' survey.
Notes: Robust standard errors in parentheses, ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Appendix Table 2
The effect of parents' migration on their child's schooling years: Results from multilevel mixed-effects

	Explanatory variables	Child's schooling years					
		(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect parameter						
	Intercept	5.844*** (1.270)	7.129*** (1.388)	4.705*** (1.346)	8.693*** (1.016)	9.732*** (1.024)	8.593*** (1.079)
(1)	The accumulated years of father's migration during child's elementary school education stage	0. 387 (0. 639)		0.587 (0.701)			
(2)	The accumulated years of mother's migration during child's elementary school education stage		−0.769 (1.195)	−1.187 (1.112)			
(3)	The accumulated years of father's migration during child's junior high school education stage				0.343 (0.523)		0.206 (0.558)
(4)						1.109	0.973

Appendix Table 2 (*continued*)

Explanatory variables		Child's schooling years					
		(1)	(2)	(3)	(4)	(5)	(6)
	The accumulated years of mother's migration during child's junior high school education stage					(0.917)	(0.863)
(5)	Male (1 = yes)	−0.761**	−0.856**	−0.789**	−0.431*	−0.432*	−0.423*
		(0.290)	(0.291)	(0.286)	(0.182)	(0.183)	(0.180)
(6)	Age	0.156**	0.155**	0.169**	0.070*	0.068	0.070
		(0.056)	(0.057)	(0.055)	(0.036)	(0.035)	(0.036)
(7)	Father's schooling	0.254***		0.260***	0.153**		0.147**
		(0.074)		(0.069)	(0.054)		(0.056)
(8)	Mother's schooling		0.127	0.131		0.038	0.023
			(0.086)	(0.081)		(0.052)	(0.055)
(9)	Non-Han (1 = yes)	−1.459***	−1.110	−0.385	−1.672*	−1.841*	−1.676*
		(0.369)	(0.705)	(0.688)	(0.661)	(0.740)	(0.693)
Random effect parameter							
(10)	Family level	6.038	6.025	5.772	6.021	6.188	5.970***
		(0.376)	(0.357)	(1.452)	(0.262)	(0.270)	(0.261)
(11)	Village level	0.542	0.558	0.488	0.376	0.482	0.344
		(0.175)	(0.201)	(0.185)	(0.120)	(0.140)	(0.116)
(12)	Observations	933	933	933	1922	1922	1922

Data source: Authors' survey.

Notes: Robust standard errors in parentheses, ***p < 0.001, **p < 0.01, *p < 0.05.

Appendix Table 3
Descriptions of child's personal characteristics and parent's migration experiences during child's compulsory school education stage

		Average	S.D	Sample size
		(1)	(2)	(3)
	The characteristics of children			
(1)	Age	21.31	2.30	859
(2)	Male (1 = yes)	0.56	0.50	859
(3)	Years of schooling	10.97	2.70	859
	The characteristics of father			
(4)	Age	46.69	4.84	859
(5)	Years of schooling	7.72	2.85	859
(6)	Migration experiences (years)	0.84	2.33	859
	The characteristics of mother			
(7)	Age	45.48	4.68	859
(8)	Years of schooling	6.22	3.30	859
(9)	Migration experiences (years)	0.20	1.23	859

Data source: Authors' survey.

Appendix Table 4
The effect of parents' migration experiences during child's compulsory school education stage on their child's schooling years: Results from OLS and FFE estimation

	Explanatory variables	Child's schooling years					
		OLS			FFE		
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	The accumulated years of father's migration during child's entire school education stage	0.100		0.056	0.193**		0.143
		(0.052)		(0.052)	(0.085)		(0.107)
(2)	The accumulated years of mother's migration during child's entire school education stage		0.093	0.083		0.210	0.241**
			(0.075)	(0.069)		(0.143)	(0.110)
(3)	Male (1 = yes)	−0.957**	−0.923**	−0.924**	−1.671**	−1.850**	−1.556**
		(0.310)	(0.308)	(0.302)	(0.749)	(0.735)	(0.710)
(4)	Age	−0.806***	−0.639***	−0.633***	−1.434***	−1.241**	−1.375***
		(0.159)	(0.158)	(0.157)	(0.440)	(0.539)	(0.482)
(5)	Father's schooling	0.289***		0.224***	0.277**		0.304**
		(0.052)		(0.053)	(0.128)		(0.123)
(6)	Mother's schooling		0.275***	0.218***		0.143	0.009
			(0.044)	(0.045)		(0.227)	(0.205)
(7)	Non-Han (1 = yes)	−1.183	−1.006	−1.283	–	–	–
		(1.022)	(0.985)	(1.009)			
(8)	Provincial dummy	included	included	included	–	–	–
(9)	Constant	29.642***	26.372***	24.653***	43.476***	40.394***	41.742***
		(3.806)	(3.824)	(3.818)	(10.538)	(13.133)	(12.171)
(10)	Observations	399	399	399	399	399	399
(11)	R-squared	0.214	0.223	0.262	0.308	0.255	0.330
(12)	Number of households	352	352	352	352	352	352

Data source: Authors' survey.

Notes: Robust standard errors in parentheses, ***p < 0.001, **p < 0.01, *p < 0.05.

Appendix Table 5

The heterogeneous effect of parents' migration during their child's junior school stage on their child's probability to attend high school: Results from LPM-FFE estimation

		Both the first year and the last year	Only the last year	Only the first year
Explanatory variables		(1)	(4)	(7)
(1)	Both parents migrated	0.042 (0.120)	0.094 (0.101)	0.106 (0.097)
	Observations	2841	2851	2847
(2)	Any parents migrated	0.060 (0.057)	0.032 (0.050)	0.046 (0.053)
	Observations	3061	3146	3087
(3)	Father migrated only	0.019 (0.063)	−0.016 (0.054)	0.014 (0.058)
	Observations	3033	3108	3058
(4)	Mother migrated only	0.019 (0.091)	0.185* (0.079)	0.153 (0.082)
	Observations	2869	2889	1098

Data source: Authors' survey.

Notes: Robust standard errors in parentheses, ***p < 0.001, **p < 0.01, *p < 0.05.

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