NO CHILD IS LEFT BEHIND? ——LEFT-BEHIND CHILDREN AND DROP-OUT RATES IN CHINA

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ABSTRACT

The education of left-behind children is of great concern during the process of urbanization in many developing countries. Using the fixed effect model and the time-varying difference-in-difference model, we examine how left-behind experiences affect children's educational choices and identities. We find that left-behind children have an approximately 2% higher probability to drop out of school. They tend to report lower levels of education expectations and education expenditures. The negative effect of left-behind experiences on education outcomes is significant, particularly among middle-school students. Despite improved living conditions, these findings suggest that left-behind experiences have hindered many children from enjoying educational success.

KEYWORDS

Left-behind children, Drop out, Education, Parental Migration

1. INTRODUCTION

According to the UNICEF 2018 Annual Report, 69 million children in China are left behind in rural areas (UNICEF, 2018). Their personal development has long been an issue under social disputes and political debates. Left-behind children are children under the age of 16 who stay in rural areas while their parent or parents depart to work in cities (Lu, 2012). Their retention rate at the age of 14 is only 88%, compared to 93.4% for their city counterparts. Multiple factors have contributed to this notable gap. Growing up without their parents around, many of them have mental health issues (He et al., 2012). Without proper guidance, many of them spend too much time on leisure over work. Furthermore, many of them need to devote more time to domestic responsibilities. From an early age, the elder children, particularly the elder girls may have to care for the younger ones and their grandparents (Chang et al., 2011). All these lead to a relatively high drop-out rate for left-behind children.

So far, studies have examined the effects of left-behind experiences on children's physical, mental, and academic performance, but primarily under the context of international migration. According to the World Migration Report 2020, there are 281 million international migrants (International Organization for Migration, 2020). Internal migration in China is substantially larger than the overall amount of international migration. Given the rising urbanization of emerging countries, it is important to investigate the consequences of left-behind experiences on the accumulation of human capital, taking China as a prime example.

This paper aims to identify the effects of left-behind experiences on children's drop-out decisions. With the progress of education reform in China, the participation rate in compulsory education has increased over the years. It is worth noting, however, that many youngsters continue to choose to drop out. Dropout decisions have long-term impact on children's lives.

Leaving school, some of them might marry young and become teenage parents when they still need care. Some might be lured to cities and without proper degrees, they take arduous jobs like their parents for a living. Some might even go to the extremes, becoming street children and thus socially marginalized. Given the negative impacts, it is of significance to understand how to address the educational problem of left-behind children.

A competitive hypothesis to the high drop-out rates of the left-behind children is the pre-existing high drop-out rates in Chinese rural areas. Rural schools fail to provide a quality education without adequate experienced teachers and school facilities, not to mention the closure of many rural schools (Brown and Park, 2002, Goodburn, 2009). This research will discuss whether the left-behind patterns, the education levels of parents, education expectations, or education expenditures have impacts on the negative effects.

The next section presents a review of related literature. Section 3 introduces the background information. Section 4 describes the methodology and data used in the research. Section 5 presents the main findings of the paper. The final section is the conclusion part.

2. LITERATURE REVIEW

Existing literature has studied important questions related to Chinese left-behind children, including physical and mental well-being, education attainments, and their academic performances (Li et al., 2015; He et al., 2012; Lu, 2012). However, it remains controversial about the effects of left-behind experiences on children's education outcomes.

2.1. Left-Behind Children's Education

It is widely acknowledged that the left-behind experiences have disadvantaged children in education. Lu (2014) supports this by the data of international and internal migration in the contexts of Mexico and Indonesia. In China, the schooling problems of children in rural areas involve multiple factors. First, left-behind children devote more time to household chores than their peers (Chang et al., 2011). In rural areas, it is common for the older siblings to find jobs early to provide additional support for the family and finance the education of younger siblings (Lu, 2012). Girls are less favored given their relatively shorter benefit periods due to fertility (Qian, 2008). Second, left-behind children are restricted from getting equal access to a quality education because of the Household Registration (hukou) system (Sieg et al, 2020). Though recent years have witnessed a decrease in education barriers, they have not been eliminated (Duan et al., 2018). Without a hukou, migrant children in cities could only choose between expensive private schools and schools intended for migrant children where tuition fees are low, but the education quality is sacrificed (Goodburn, 2009). The final straw is the requirement for many migrant children to take the college entrance exam in their registered permanent residences. Therefore, most children are left behind in their hometowns with poor schooling. Finally, left-behind children have relatively lower physical well-being levels and higher risks of getting mentally ill (Lee, 2011). Li et al. (2015) find the negative impact of lack of parental care on the physical health of left-behind children. Among them, girls and younger children appear to be more vulnerable. The situation would be worse for children with lower socioeconomic status and lower levels of social support (He et al., 2012).

2.2. Parental Effects on Left-Behind Children

There are two main opinions about the effects of parental migration on left-behind children's schooling performances. One is the income effects, and the other is the parental care effects. As

for the income effect, in China, parents migrate to bigger cities to get better-paid jobs (Lu Y., 2012). With improved financial status, parents are more likely to have higher education expectations on their children and increase their investment in children's education (Minello and Barban, 2012). Moreover, migrant mothers tend to have higher powers in household choice-making, which is beneficial to their children's education (Goodburn, 2019). However, as pointed out in Todaro & Smith (2013), with the increase in income, the families' investment in education would not directly increase given its costs versus benefits. Gustafsson and Shi (2004) claim that the increase of expenditures on education has pushed more people into poverty in the rural part of China. Besides, left-behind children composite an indispensable part in their household chores (Chang et al., 2011). Contrarily, the benefits of education are relatively backloaded and thus, being somehow underestimated in rural areas in China (Bhattacharya et al., 2013). Further, it would lower migrant workers' education expectations on their children and reduce investments in education. As for parental care, Lu (2012) shows the negative impact of lack of care on left-behind children's grades. More commonly, the responsibility of educating left-behind children is shifted to their grandparents, who would either be too stringent on them or too doting. Without enough emotional support, children are more likely to have disobedient behaviors and might drop out of school, as a sign of "freedom" (Luo et al., 2009). Segregation from their parents might have positive or negative or even mixed effects on children's schooling and we would examine the total effects of left-behind experiences on children's probability of dropping out and its possible mechanisms.

3. BACKGROUND

3.1. The Household Registration System in China

The Household Registration System has been formally implemented in China since 1958 (Lu, 2016). Entering the 1980s, China's reform and opening-up has created lots of vacancies in cities and have attracted millions of migrant workers. Nevertheless, with more and more rural workers flooding into cities, people are more concerned about problems such as congestion, rising crime rates, and rocketing housing prices (Lu et al., 2021). To prevent the brain-drain and limit international immigration, countries would issue corresponding policies (Lu et al., 2021). Similarly, The Hukou System was useful during the underdeveloped period (Lu and Chen, 2004). With the rapid development of the economy, the Hukou system has hindered the free movement of laborers (Alfridi et al., 2015). Therefore, rural migrants, like other migrants, come to prosperous cities for better lives, but treated as 'guest workers' (Meng and Xue, 2020). They could not enjoy equal access to the labor market, education, health care, and other public services as residents, so as their children (Sieg et al., 2020).

Besides, rural migrants usually take laborious work and work overtime, they could not spare time to take care of their children (An et al., 2020). Their incomes could not cover the costs of all family members living in the cities. Therefore, they usually had to leave their children in their hometown. In China, migration is the main cause of children being left behind, other causes like divorce, and nonmarital fertility are relatively less common, especially in rural areas (Lu, 2012). This is the beginning of the story of left-behind children.

3.2. Education in China

Every Chinese citizen must complete nine years of compulsory education. Compulsory education in China consists of five to six years of primary school education and three to four years of junior secondary school education. Required by the law, children enter primary school at the age of six or seven. They could be enrolled into junior secondary schools based on places of residence.

Since 2006, compulsory education is free of tuition and miscellaneous fees. In 2015, textbooks can only be priced at marginal profit according to the law (OECD, 2016). So far, direct investment in rural education and funded special programs have facilitated the increase of enrolment rate of left-behind children and other rural children. Since 2010, the enrolment rate of primary-school-aged students has been above 99.7%. In 2020, the retention rate of compulsory education is 95.2%, which is 4.1% higher than that in 2010 (National Bureau of Statistics of China, 2021).

However, it remains notable that there is a gap between the two rates. The urban-rural gap plus regional differences persist. Issues other than funding are yet to be solved. Better schooling environments without enough qualified teachers could not stop migrant worker parents from sending their children to schools away from their hometowns, forming a group of urban left-behind children (OECD, 2016). Some children remain left-behind because of the restrictions. Given that children have little autonomy in family decision-making, they could only choose to accept the arrangements or find jobs to earn their autonomy (Goodburn, 2019). Admittedly, more actions should be taken to offer support for the migrant children.

4. DATA AND METHODOLOGY

4.1. Data Source and Participants

Data used in this research are from the Chinese Family Panel Survey. The CFPS is a national and comprehensive social survey project in China. This survey started in 2010 and is conducted every two years, consisting of around 16,000 households each wave. This paper uses the available CFPS2010 to CFPS2018, forming five-period panel data. We limited this research to children aging from 6 to 16, who live with their parents for less than 2 to 4 months per year.

4.2. Measures

4.2.1. Drop Out

Drop out was measured based on 'are you still at school?' or 'are your child still at school?' The index equals 1 when the participants are still at school and equals 0 when they are not in each wave. The measure has already ruled out the condition that children are on vacation.
Education expectation: Education expectation is measured with the question 'Which degree do you think you should achieve at least?' and 'Which degree do you think your child should achieve at least?' Respondents are asked to indicate their expectations on a 9-point (11- point for 2018 wave) scale.

4.2.2. Left Behind

We identify children as left-behind children when they are living 2-4 months or shorter with their parents (Duan and Zhou, 2005; Liang et al., 2016). The index equals 1 when the participants are left behind and 0 when they are not. We have included urban left-behind children to further identify the interested effects instead of mixing them up with the effects of being in rural China.

In this research, control variables were included to account for school, family, and individual effects on education in rural China (Brown and Park, 2002; Zhang et al., 2002). The school controls include key schools and boarding schools. The family controls include family size, average family income, total assets, father's age, father's education years, father's marital status,

mother's education status, number of children at home, and number of boys at home. We also include age, gender, minority groups, and hukou status as individual controls.

4.3. DESCRIPTIVE STATISTICS

Table 1 presents details about the participants. There are in total 27,421 respondents and 34.7% of them are left-behind children. The average probability of dropping out for left-behind children is 6%, which is 1.6% higher than their non-left-behind counterparts. The average education expectation of left-behind children is 5.621 years, which is lower than that of non-left-behind ones. Similarly, the average education expenditure for left-behind children is lower (measured in terms of log). The average age of left-behind children is 11.042 years and63.9% are holding a rural hukou (11.6% higher than that among non-left-behind participants). 23% of them (compared to 20% of non-left-behind children) study in key schools and 37.9% (compared to 28.2% of non-left-behind ones) study in boarding schools and could choose to live in the dormitory. 28% of the left-behind participants in this research are left behind only by their fathers, accounting for about 10% of the whole sample (compared with 12% left behind only by their mothers, accounting for about 4% of the whole sample). Nearly 20% of the children's participants are left behind by both of their parents. The average age of the non-left-behind respondents is 10.556 years. Both the average father's education years and mother's education years of left-behind children are lower than those of non-left-behind respondents. So do the average family income and total assets. However, the average family size and number of boys at home for left-behind children are relatively higher.

Table 1 Descriptive Statistics

Variable	Whole sample		Left-behind children		Non-left-behind children	
	Mean	SD	Mean	SD	Mean	SD
Explanatory variables						
Drop out	0.050	0.22	0.060	0.24	0.044	0.21
Education expectation	5.707	1.40	5.621	1.39	5.752	1.39
Log of education expenditure	6.562	2.20	6.535	2.40	6.576	2.09
Predictor variables						
Left-behind children	0.347	0.48	1.000	0.00	0.000	0.00
Left-behind only by mother	0.042	0.20	0.120	0.32	0.000	0.00
Left-behind only by father	0.097	0.30	0.280	0.45	0.000	0.00
Control variables						
Age	10.725	3.13	11.042	3.30	10.556	3.02
Gender	0.526	0.50	0.521	0.50	0.528	0.50
Minority group	0.128	0.33	0.122	0.33	0.131	0.34
Rural	0.564	0.50	0.639	0.48	0.523	0.50
Key school	0.210	0.41	0.230	0.42	0.200	0.40
Boarding school	0.316	0.46	0.379	0.48	0.282	0.45
Father's education years	7.847	4.06	7.741	3.77	7.902	4.20
Father's age	39.104	6.02	38.844	6.16	39.239	5.94
Father's marital status	2.071	0.40	2.200	0.66	2.006	0.13
Mother's education years	6.633	4.50	6.355	4.30	6.775	4.60
Log of average family income	8.597	1.37	8.582	1.28	8.605	1.41
Log of total assets	14.765	0.22	14.735	0.22	14.781	0.22
Family size	5.126	1.90	5.159	1.99	5.109	1.85
Numbers of children	1.453	1.24	1.364	1.30	1.500	1.21
Numbers of boys	1.026	0.78	1.077	0.82	0.999	0.76
Numbers of observation	27,421	27,421	9,523	9,523	17,898	17,898

4.4. Empirical Models

First, we use the Fixed-Effect Model to investigate the relationship between left-behind experiences and children's drop-out choices. Considering our main dependent variable, we run the simple and practical linear probability regressions for the equation:

$$Y_{ipt} = \beta_0 + \beta_1 L_{ipt} + \sum controls + \alpha_t + \lambda_p + \epsilon_{ipt} \quad (1)$$

Where Y_{ipt} is the index of whether child i in province p and year t (from 2010 to 2018) drop out of school. L_{ipt} is the index of whether child i in province p and year t is left behind. We include year fixed effects α_t to control for the time-variant factors, and province fixed effects λ_p to control for the time-invariant but location-variant omitted variables. $\sum controls$ denotes all the control variables we include. ϵ_{ipt} is the error term.

To isolate the effect of being left behind on dropping out, we introduce a time-varying difference-in-difference model given the different timing of children to be left behind. We run the regressions shown in Table 3 for the equation:

$$Y_{it} = \beta_0 + \beta_1 D_{i,t} + \beta * \sum controls + \lambda_t + \gamma_p + \epsilon_{ipt} \ (2)$$

Where $D_{i,t}$ is the individual treated dummy variable which equals 1 if child i has changed into a left-behind child in time t. λ_t is the year fixed effect and γ_p is the province fixed effect. Event study has been employed to test the parallel trends:

$$Y_{it} = \beta_0 + \sum_{j=-M}^{N} \delta_j L_{i,t-j} + \beta_1 D_{i,t} + \beta * \sum controls + \lambda_t + \gamma_p + \epsilon_{ipt} \ (3)$$

δ_j captures the differences in outcome between the treatment and control groups in each survey year. $L_{i,t-j}$ is a dummy of the year when a child has become a left-behind one. To control for the possible observable bias, we re-examine the effect using the generalized DID model on a detailed matched data with individual, family and school heterogeneity controlled. We first calculate the propensity scores of each observation and then match the treated group with the control group using nearest neighbors matching, setting the neighbor to be 4. After matching, we get a sample of 12,573:

$$Y_{pt} = T_{pt}\beta + \theta_p + \lambda_t + \epsilon_{pt} \ (4)$$

Where $T_{pt} = 1$ if the treatment is in place in province p and year t; $T_{pt} = 0$ otherwise. θ_p is the province effects and λ_t is the year fixed effects. ϵ_{pt} is the error term. The pre-treatment trends are tested using the following equation:

$$Y_{pt} = T_{pt}\beta_0 + T_{pt+1}\beta_1 + \cdots + T_{pt+m}\beta_k + \theta_p + \lambda_t + \epsilon_{pt} \ (5)$$

To further study the underlying mechanism, we used the causal step regression model. Based on the regression we have run, we added new regressions:

$$E_i = \alpha_0 + \alpha_1 D_{i,t} + X_i' + \epsilon_i \ (6)$$
$$P(y_i = 1|x) = \beta_0 + \beta_1 D_{i,t} + \beta_2 E_i + X_i'\gamma + \epsilon_i \ (7)$$
$$EE_i = \alpha_0 + \alpha_1 D_{i,t} + X_i' + \epsilon_i \ (8)$$
$$P(y_i = 1|x) = \beta_0 + \beta_1 D_{i,t} + \beta_2 EE_i + X_i'\gamma + \epsilon_i \ (9)$$

Where E denotes the measure of education expectation and EE denotes log of education expenditure. Controls are also included in the regressions. The heterogeneity section estimates equation (1) using the sample of primary school respondents and that of middle school respondents respectively. We have also changed the independent variables into left behind only by mother and left behind only by father.

5. MAIN RESULTS

5.1. Left-Behind Children and Education Performances: Fixed Effect Estimates

Table 2 Fixed Effect Estimates

	(1)	(2)	(3)
	Dependent	variable:	Drop out
Left behind	0.021***	0.024***	0.020***
	(6.74)	(7.97)	(6.36)
Age	0.009***	0.010***	0.010***
	(12.99)	(18.44)	(18.26)
Gender	-0.005	-0.003	-0.004
	(-1.36)	(-1.04)	(-1.23)
Minority group	0.067***	0.065***	0.067***
	(12.34)	(12.84)	(13.09)
Rural	-0.000	0.002	0.004
	(-0.07)	(0.77)	(1.40)
Key school	-0.052***	-0.051***	-0.051***
	(-28.59)	(-15.05)	(-15.00)
Boarding school	-0.093***	-0.099***	-0.098***
	(-29.82)	(-30.79)	(-29.93)
Father's education years	-0.004***	-0.003***	-0.003***
	(-8.15)	(-8.04)	(-7.80)
Father's age	0.001***	0.001***	0.001***
	(3.39)	(3.46)	(3.60)
Father's marital status	0.010**	0.009**	0.011***
	(2.15)	(2.19)	(2.71)
Mother's education years	-0.002***	-0.002***	-0.002***
	(-4.00)	(-5.40)	(-4.74)
Average family income	0.000	-0.000	0.000
	(0.14)	(-0.14)	(0.15)
Total assets	-0.011**	-0.011	-0.003
	(-2.12)	(-1.36)	(-0.31)
Family size	0.000	0.000	0.001
	(0.44)	(0.53)	(0.74)
Numbers of children	0.002	0.002*	0.002
	(1.59)	(1.96)	(1.30)
Number of boys	0.006**	0.005**	0.006**
	(2.29)	(2.05)	(2.41)
Constant	0.101	0.156	0.017
	(1.36)	(1.29)	(0.14)
Number of Observations	24,181	24,172	24,172
R-squared	0.082	0.093	0.094
Province Fixed Effect		YES	YES
Year Fixed Effect			YES

Note: average family income and total assets are measured in log terms. Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 2 shows the results to Equation (1). Overall, there is a strong positive correlation between children's left-behind experience and their probability of dropping out of school. Left-behind experiences could explain about 9% of the variation in the probability of dropping out of school.

Column (1) is the OLS regression of equation (1). On average, the chances for left-behind children to drop out of school would be 2.1% higher than other students, which is significant at the confidence level of 1%. The effect has been magnified to 2.4% with province fixed effect controlled and becomes 2.0% with both province and year fixed effect controlled. This could be due to two reasons. First, the variable of left behind is measured with errors, which may lead to a larger attenuation bias with both fixed effects included. Second, due to the omitted year and province factors, we would observe larger impact of left-behind experiences on drop-out choices without controlling for them.

The associations of other control variables are also statistically significant and have sensible signs and attitudes. Age is one among them and thus it would be of importance to classify children into primary school students and junior secondary school students. Belonging to a minority group might increase the probability for a left-behind child to drop out of school. Besides, if a child is a left-behind child, whose parents have divorced, has an aged father and more than one brother at home, then his or her probability of dropping out of school would significantly increase. Contrarily, it is not surprising that being in a key school, boarding school, having well-educated parents and more family assets would significantly decrease the probability for a child to drop out of school. The magnitude and sign of the coefficients are consistent with province fixed effect and year fixed effect controlled.

5.2. Left-Behind Children and Dropout Rates: Time-Varying DID Results

Table 3 Time-varying DID Results

	(1)	(2)
	Drop out	Drop out
Left behind	0.015***	0.021***
	(2.80)	(3.86)
Age		0.047***
		(3.09)
Gender		0.016
		(0.68)
Minority group		-
Rural		-0.053*
		(-1.74)
Key school		-0.050***
		(-13.47)
Boarding school		-0.097***
		(-16.49)
Father's education years		-0.001
		(-0.40)
Father's age		0.001
		(0.35)
Father's marital status		-0.002
		(-0.17)
Mother's education years		0.004**
		(2.30)
Average family income		0.003**
		(1.99)
Total assets		-0.018
		(-1.48)
Family size		-0.000
		(-0.12)
Numbers of children		-0.000
		(-0.20)
Number of boys		-0.019**
		(-2.51)
Constant	0.098	-0.237
	(1.03)	(-0.70)
Number of Observations	25,653	22,637
R-squared	0.010	0.056
Time Fixed Effects	YES	YES
Province Fixed Effects	YES	YES

Notes: per person income and total assets are measured in log terms. Robust t-statistics in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0$

Table 3 presents the results to Equation (2). Column (1) only includes fixed effects, and shows that left-behind children are more likely to drop out of school. The second column adds more controls, with a more significant and magnified coefficient of interest. On average, once being left behind increases the probability for children to drop out of school by 2.1% at the significance

level of 1%. This estimate is larger than the Fixed-Effects estimates reported in Table 2, with both fixed effects included. It further confirms that the negative effect of left-behind experiences outweighs its income effect and the effect is persisting. With the increase in age, this probability will even increase. Studying in key schools reduces the probability of dropping out by 5% and studying in boarding schools reduce the probability by 9.7%. The results are largely consistent with what we have got using the fixed-effect model. Contrarily, mother's education years and average family income are positively related to the probability of dropping out, while number of boys at home and holding a rural *hukou* is negatively related to our dependent variable of interest. This is probably due to the selection bias that some left-behind children are included in the control group in the survey year when they have not been left behind. We will try to solve this problem by introducing the propensity-score-matching model.

To testify the assumption of parallel trend, we have used event study and plotted the relationship between drop-out rate and year relative to left-behind year in graph 1. As could be seen from the graph, the coefficients of periods before treatment are all 0 at the 95% significance level, which justifies the parallel trend assumption. The coefficients of periods after treatment are all significantly greater than 0 at the significance level of 95%, which convinces the positive treatment effect of left-behind experiences on drop-out choices.
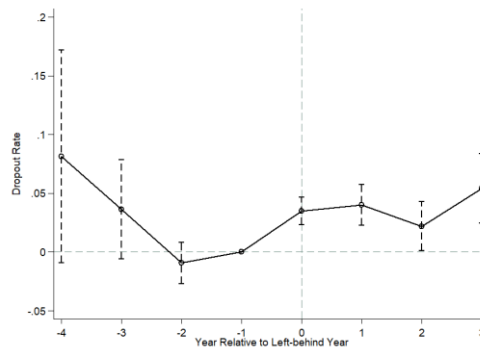

Figure 1 Event study for Time-varying DID model

5.3. Robustness Checks

Table 4 Left-behind Effects: difference-in-difference estimates on the matched sample

	(1)	(2)	(3)	(4)
	Drop out	Drop out	Drop out	Drop out
T_t	0.048***	--	0.051***	--
	(3.49)		(3.51)	
T_{pt}	--	0.001***	--	0.001***
		(3.55)		(4.05)
Age	0.110***	-0.004***	0.115***	-0.006***
	(3.50)	(-3.01)	(3.32)	(-7.11)
Key school	-0.067***	-0.038***	-0.068***	-0.034***
	(-5.05)	(-9.65)	(-4.66)	(-11.79)
Boarding school	-0.097***	-0.072***	-0.092***	-0.065***
	(-6.53)	(-15.05)	(-5.93)	(-18.67)
Father's education years	-0.001	-0.003***	-0.002	-0.002***
	(-0.17)	(-4.22)	(-0.55)	(-4.46)
Father's age	-0.007	0.001	-0.001	0.001***
	(-0.58)	(1.42)	(-0.09)	(3.27)
Father's marital status	-0.023	0.074**	-0.012	0.084***
	(-0.51)	(2.17)	(-0.29)	(3.01)
Mother's education years	0.009**	-0.001*	0.011***	-0.002***
	(2.43)	(-1.66)	(2.63)	(-3.55)
Numbers of children	-0.006	-0.003	-0.004	-0.003*
	(-1.09)	(-1.23)	(-0.63)	(-1.72)
Number of boys	-0.011	0.013***	-0.009	0.009***
	(-0.58)	(2.81)	(-0.47)	(2.69)
Constant	-1.122	0.103	-1.399	0.217
	(-0.84)	(0.34)	(-1.03)	(0.87)
Number of Observations	12,573	12,572	22,315	22,314
R-squared	0.058	0.071	0.059	0.070
Time dummies	included	included	included	included
Province dummies	--	included	--	included

Note: All control variables are included in the analysis but some were omitted from the table.
per person income and total assets are measured in log terms. Robust t-statistics in parentheses*** p<0.01,
** p<0.05, * p<0.1

Table 4 displays the results of Equation (4). We match each treatment with a control group based on its weight to control for the possible observable bias. The results in column (1) and column (2) strengthened the robustness of our main findings in Table 2 and 3. We have further redone the process using a frequency weighted regression, expanding the sample size to 22,315. The results in column (3) and column (4) remain consistent with previous ones, with a bigger magnitude. Similar with the results in Table 2, parents' education years are negatively related to children's probability of dropping out of school, while the number of boys at home is positively related to our dependent variable of interest. Graph 2 is the plot for the event study testing the parallel trend for the PSM-DID model. Before treatment, according to the graph, the confidence intervals are narrower, and the coefficients are 0 at the significance level of 5%. After treatment, the coefficients are further significantly greater than 0. Thus, the assumption of parallel trend also justifies itself.
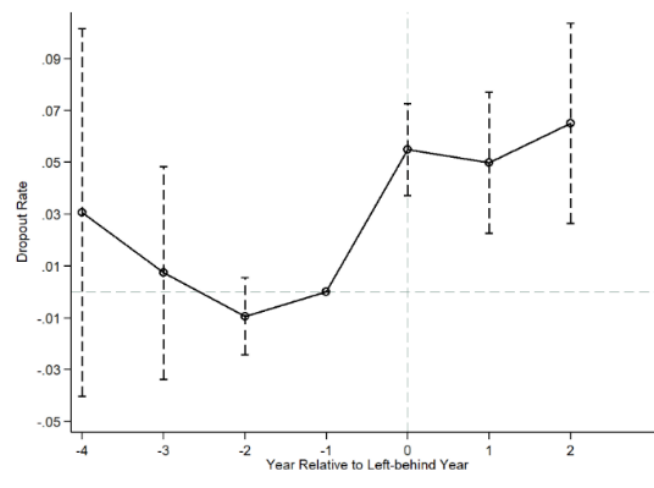
Figure 2 Event study for PSM-DID Model

6. MECHANISM

6.1. Education Expectations and Education Expenditure

Lower education expectations and lower investments in education can contribute to drop-out choices (Mughal et al., 2019). In this section, we investigate how left-behind experiences affect these two factors and thus affecting children's drop-out choices. Frist, we replace dependent variables into education expectation and education expenditure. Results are shown in Table 5. Column (1) and column (2) show that left-behind children have significantly lower average education expectations by 0.062, with province fixed effect controlled. The effect becomes insignificant after controlling for year fixed effect, which implies that with the implementation of education reform, the differences in terms of education expectation become insignificant among left-behind children and non-left-behind children. Education expenditure is significantly correlated with both fixed effects controlled. Column (5) shows that considering province differences, left-behind children have a significant 5.2% higher education expenditure. While column (6) shows that with time, left-behind children's education expenditure has been significantly reduced by 15.4%. Here the measure of education expenditure is the expenditure actually paid, excluding other waivers. This is probably due to the implementation of education reforms in rural China, which has helped to relieve the financial burden of left-behind children's parents. Another possible explanation is that since left-behind children have a higher probability of dropping out of school, accordingly their education expenditure on average is lower, which again justifies our main results. Therefore, the income effect of left-behind experience is partially refuted. Though left-behind children have no significant differences from their counterparts in terms of education expectations, they are disadvantaged in education by their left-behind experiences. Their parents migrate for a greater life, but it has not increased their children's education expenditure and their probability of education success. It is also notable that the coefficient before our index of children holding a rural hukou becomes significant after including the time fixed effects. Concerns for education equity are yet to be addressed.

6.2. Mediation Effects

We follow Baron and Kenny (1986) steps to establish our mediator analysis. Specifically, three criteria should be satisfied. As for education expectations, first, we testify that left-behind experiences affect the probability of dropping out. The measure of left behind used here is the

treatment constructed in the difference-in-difference section. Second, left-behind experiences must correlate with education expectations. Third, when both left-behind experiences and education expectations are included in the regression, the effect of left-behind experiences is reduced. We analyze the mediator effect by age groups given the importance of age in previous results. Students are divided into primary-school-aged students (6-12) and middle-school-aged students (13-16). The results shown in Table 6 support for mediation with primary school students and middle school students. Column 1 shows that the significant and positive relationship between left-behind experiences and children's probability of dropping out of school for middle school students. Column 2 confirms the validity of criteria 2. Finally, when including both education expectations and left-behind experiences, the coefficient before left-behind experiences reduces from 0.046 to 0.031, and the coefficient before both variables remain statistically significant at the confidence level of 1%. Therefore, education expectation does partially mediate between left-behind experiences and the probability of dropping out of school for middle school students. Following the same steps, we find support for the mediation with primary school students. As could be seen from column 4 to column 6, all the three criteria are satisfied (criteria 1: b_1= -0.011, p <0.01; criteria 2: b_2=-0.042, p < 0.1; criteria 3: b_3=-0.011, p<0.01, b_4 =-0.006, p <0.01). However, different from middle school students, left-behind experiences are negatively correlated with the probability of dropping out of school for primary school students. Migrant parents could provide them with more financial support to go to school. Nevertheless, left-behind children studying in secondary high school tend to have lower education expectations and be more likely to drop out of school.

Left-behind experiences would have long-term effect on children. We have redone the analysis using education expenditure as mediator for middle school students on the matched sample which we got using propensity score. Similarly, criteria are satisfied. Column 3 in Table 7 shows that left-behind children in middle school have significantly higher education expenditure, which has partially helped to alleviate the negative effect of left-behind experiences on their education outcomes. However, the mediation effect does not seem to exist for primary school students given the insignificant relationship between their left-behind experiences and the probability of dropping out. It is suggested that if we put primary-school-aged left-behind children in the same family conditions and school environment as their counterparts, their probability of dropping out of school would not be significantly different from their peers. Early intervention to support left-behind children would have long-term positive effects on their education outcomes.

Table 5 Fixed Effect models with education expectation and education expenditure as dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Education Expectation			Education Expenditure		
Left behind	-0.062***	-0.062***	0.013	0.023	0.052*	-0.154***
	(-3.18)	(-3.17)	(0.66)	(0.81)	(1.85)	(-5.17)
Rural	-0.001	-0.021	-0.072***	-0.315***	-0.278***	-0.287***
	(-0.03)	(-1.07)	(-3.79)	(-11.08)	(-9.76)	(-10.12)
Key school	0.264***	0.258***	0.264***	0.360***	0.392***	0.322***
	(12.09)	(11.86)	(12.62)	(11.17)	(12.35)	(10.18)
Father's education years	0.042***	0.043***	0.040***	0.038***	0.037***	0.035***
	(15.40)	(15.43)	(15.30)	(9.50)	(9.51)	(8.94)
Total assets	0.282***	0.403***	0.117**	0.811***	0.675***	0.527***
	(5.94)	(7.79)	(2.33)	(11.55)	(8.94)	(6.91)
Numbers of children	-0.052***	-0.047***	-0.014*	-0.038***	-0.029***	-0.015
	(-7.10)	(-6.44)	(-1.96)	(-3.58)	(-2.75)	(-1.34)
Observations	21,842	21,840	21,840	24,139	24,130	24,130
R-squared	0.153	0.164	0.236	0.182	0.211	0.226
Province FE		YES	YES		YES	YES
Year FE			YES			YES

Note: Control variables are included in the analysis but omitted in this table. per person income and total assets are measured in log terms. Robust t-statistics in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6 Causal step approach for education expectation by age groups

variables	Criterion 1 for middle school students	Criterion 2 for middle school students	Criterion 3 for middle school students	Criterion 1 for primary school students	Criterion 2 for primary school students	Criterion 3 for primary school students
Left behind	0.046***	-0.129***	0.031***	-0.011***	-0.042*	-0.011***
	(7.75)	(-4.00)	(5.51)	(-3.55)	(-1.70)	(-3.44)
Education expectation			-0.043***			-0.006***
			(-21.80)			(-5.85)
Observations	8039	7725	7725	16,142	14,117	14,117

Note: Control variables are included in the analysis but omitted in this table. t-statistics in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7 Mediation effect analysis for education expenditure by age groups on matched sample

variables	Criteria 1 for middle school students	Criterion 2 for middle school students	Criterion 3 for middle school students	Criterion 1 for primary school students	Criterion 2 for primary school students	Criterion 3 for primary school students
Left behind	0.050***	0.509***	0.014***	-0.013	0.29*	-0.006***
	(3.89)	(7.18)	(1.29)	(-1.03)	(4.17)	(-0.53)
Education expenditure			0.014***			0.007***
			(5.83)			(4.07)
Observations	4,010	3,689	3,689	8,563	7,822	7,822

7. HETEROGENEITY

7.1. Primary School Students versus Middle School Students

Table 8 Primary school students versus middle school students

	(1) Primary school	(2) Primary school	(3) Primary school	(4) Middle school	(5) Middle school	(6) Middle school
			Drop out			
Left behind	-0.011***	-0.009***	-0.001	0.046***	0.048***	0.021***
	(-3.85)	(-2.98)	(-0.26)	(7.48)	(8.11)	(3.11)
Age	-0.012***	-0.011***	-0.012***	0.055***	0.056***	0.055***
	(-13.53)	(-15.28)	(-16.23)	(19.26)	(21.53)	(21.05)
Gender	-0.011***	-0.010***	-0.011***	-0.002	0.000	-0.002
	(-3.14)	(-3.10)	(-3.25)	(-0.25)	(0.02)	(-0.31)
Key school	-0.021***	-0.019***	-0.012***	-0.072***	-0.073***	-0.078***
	(-14.27)	(-5.10)	(-3.35)	(-19.84)	(-11.92)	(-12.84)
Boarding school	-0.033***	-0.037***	-0.029***	-0.184***	-0.201***	-0.211***
	(-16.98)	(-10.25)	(-8.00)	(-28.93)	(-34.71)	(-36.02)
Father's education years	-0.003***	-0.002***	-0.002***	-0.005***	-0.005***	-0.005***
	(-5.30)	(-5.03)	(-4.49)	(-6.01)	(-6.04)	(-6.35)
Father's age	-0.000	-0.000	0.000	0.003***	0.003***	0.002***
	(-0.28)	(-0.28)	(0.96)	(5.22)	(5.34)	(4.02)
Father's marital status	0.002	-0.000	-0.000	0.030***	0.029***	0.036***
	(0.48)	(-0.03)	(-0.09)	(2.92)	(3.77)	(4.70)
Mother's education years	-0.002***	-0.002***	-0.001**	-0.002*	-0.003***	-0.004***
	(-4.20)	(-3.70)	(-2.09)	(-1.95)	(-4.27)	(-4.57)
Total assets	-0.006	-0.013	0.006	-0.032***	-0.013	-0.029*
	(-1.12)	(-1.62)	(0.78)	(-2.82)	(-0.79)	(-1.68)
Number of boys	0.008***	0.007***	0.008***	0.011*	0.009*	0.009*
	(2.96)	(3.08)	(3.51)	(1.95)	(1.73)	(1.87)
Constant	0.277***	0.445***	0.161	-0.349**	-0.576**	-0.356
	(3.59)	(3.66)	(1.30)	(-2.06)	(-2.25)	(-1.37)
Number of Observations	16,142	16,138	16,138	8,039	8,034	8,034
R-squared	0.061	0.076	0.087	0.218	0.243	0.256
Province FE		YES	YES		YES	YES
Year FE			YES			YES

Note: All control variables are included but some omitted. Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Previous results suggest that left-behind experiences have different impacts on children from different ages groups. We investigate whether there are different effects for primary school students and middle school students. Table 8 shows the results. After controlling for both province fixed effect and year fixed effect, as shown in column (3), the effect is insignificant for left-behind children in primary school. The coefficient of interest is only -0.001, not statistically significant nor large in magnitude. Nevertheless, left-behind children in middle school have a significant high probability to drop out. For primary school students, aging means less likely to drop out while the opposite is true for middle school students. Left-behind children would choose to drop out facing the increasing costs of entering middle school and the opportunity costs of taking jobs. For primary school students, boys are less likely to drop out while there is no significant gender difference for middle school students. Being in a key school and boarding school could significantly decrease the probability of dropping out by 7% and about 20% respectively for middle school students. This is probably owing to higher quality teachers and reduced transportation costs. Besides, middle school students' choices are more likely to be affected by family controls, except for the number of boys at home.

7.2. Left Behind only by Mother versus Left Behind only by Father

Table 9 left behind only by mother versus left behind only by father with different dependent variables

	Whole Sample (1)	Whole Sample (2)	Whole Sample (3)	Whole Sample (4)	Whole Sample (5)	Whole Sample (6)
Panel A	Drop out	Drop out	Education expectation	Education expectation	Education Expenditure	Education expenditure
Left-behind	0.015**	--	-0.097**	--	-0.007	--
only by mother	(1.99)		(-2.06)		(0.97)	
Left-behind	--	-0.013***	--	-0.022	--	-0.076*
only by father		(-2.81)		(-0.74)		(-1.71)
Age	0.010***	0.010***	-0.099***	-0.099***	-0.035***	-0.036***
	(18.85)	(18.66)	(-29.07)	(-29.05)	(-7.15)	(-7.24)
Rural	0.006**	0.006**	-0.071***	-0.071***	-0.301***	-0.299***
	(1.99)	(2.09)	(-3.72)	(-3.72)	(-10.67)	(-10.61)
Boarding	-0.097***	-0.097***	0.158***	0.158***	1.053***	1.054***
school	(-29.69)	(-29.64)	(7.81)	(7.79)	(34.66)	(34.69)
Father's	-0.003***	-0.003***	0.040***	0.040***	0.035***	0.035***
education years	(-7.64)	(-7.67)	(15.25)	(15.31)	(8.88)	(8.87)
Mother's	-0.002***	-0.002***	0.042***	0.042***	0.043***	0.043***
education years	(-4.68)	(-4.75)	(16.35)	(16.39)	(11.33)	(11.29)
Number of	0.006***	0.006**	-0.114***	-0.114***	-0.133***	-0.132***
boys	(2.66)	(2.74)	(-7.76)	(-7.74)	(-6.12)	(-6.06)
Constant	0.079	0.092	4.612***	4.661***	-1.740	-1.665
	(0.64)	(0.74)	(6.08)	(6.13)	(-1.52)	(-1.45)
Observations	24,172	24,172	21,840	21,840	24,130	24,130
R-squared	0.093	0.093	0.236	0.236	0.225	0.225
Province FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Note: All control variables are included but some omitted.
Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In Table 9, column (1) shows the results for children left behind only by mothers, and column (2) shows the results for those left behind only by fathers. The coefficient before left behind only by mother is positive and statistically significant, while that of left behind only by father is negative but also statistically significant. Though the magnitude of the effect of being left behind only by mother (0.015) is slightly larger than that of being left behind only by father (-0.013), the latter one is more significant (at the 1% confidence level). With father working in cities and mother caring for the family, the probability of left-behind children to drop out of school would be significantly reduced. It implies that fathers would fail to provide enough emotional support for their children. Besides, children being left behind only by their mother on average have statistically significant 0.097 lower education expectations. However, they have no significant difference in terms of education expenditure. Less parental care, more time invented on household chores, and wishes to share the family financial burden instead of getting further education could help explain the higher drop-out probabilities when left behind only by mothers. As for children left behind only Nevertheless, their average education expenditure is 7.3% significantly lower. Income earned by their fathers has not transferred into higher investment in education. Ye (2017) points out that many migrant workers reckon that the costs of education outweigh the benefits. What is worse, many busy working migrant parents might fall into the "trap of attention" and become even more shortsighted.

8. CONCLUSIONS

This research examines whether and to what extent left-behind experiences disadvantaged children. Constituting more than a fifth of the Chinese children, left-behind children are still hindered from enjoying the same educational successes as their city counterparts. Although China has made great progress in educational reforms, more actions are to be taken besides financing. Usually reluctantly separated from their parents, left-behind children have to cope with various stresses themselves. Understanding of informal channels may help alleviate this problem.

The first contribution of this paper is to provide further evidence about the unintended costs of migration, including the negative effects of left-behind experience on children's education outcomes, education expectations, and education expenditure. We find that being left behind would significantly increase children's probability of dropping out of school by 2.1%. Besides, the negative effects are shown to be long-standing. Growing older, the positive link between left-behind experience and the probability of dropping out of school becomes even more significant. Second, we provide an insight into how left-behind experiences results in drop-out choices. We find that left-behind children tend to have lower education expectations and education expenditures and thus a higher probability of dropping out of school. Contrary to common belief, we find that children have no significant differences in terms of education expectations. One conjecture is that dropping out is not entirely an active choice but somehow a passive response due to the limitations. However, our results also support that higher input in early education could help alleviate the negative effect of left-behind experiences on children's education outcomes. A third contribution is to further demonstrate the importance of fathers in children's education. Parents are not only sources of financial support for children, but also important sources of family education. Admittedly, mother and father may have different effects on children's education. Nevertheless, the results of this research support that the attitudes and deeds of fathers might have a more significant effect on their children, which echoes findings of past researches that fathers' active engagement is important for children's development (Allport et al.2018; Offer and Kaplan, 2021).

The importance of equality in compulsory education are worth noting. Despite the improved education conditions throughout the years, problems of education for left-behind children could not be fully settled by simply increasing the financial input. Earlier intervention is essential

because left-behind experiences have a long-term effect on children. It would be a lesson for migrant parents to learn to communicate with their children, especially adolescents.Teachers, and communities could also play their part in connecting children being left behind in rural areas with their parents working away from home.

Though the research has some strengths (e.g., avoid subjective measures by using drop out as the main dependent variable, include urban left-behind children), there are also several limitations. First limitation relates to the measure of education expectation. The data related to education expectations for children under 10 years old in 2010 and 2012 are proxied by their guardians, whose credibility needs further refinement through more careful survey design. Besides, primary school students tend to have higher education expectations. Chances are that the effects of left-behind experiences on education expectations have been underestimated. A second potential limitation is that we do not have sufficient evidence to identify whether children are voluntarily left behind in city areas or not. Many parents are sending their children to better schools in areas other than their hometowns. But some students are leaving their hometown out of the pursuit of a higher power in household decision-making. More work could be done to study whether being left behind means more autonomy for children and what causes them to think positively or negatively.

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