



## Effects of Parental Migration on Mental Health of Left-behind Children: Evidence from Northwestern China

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### Abstract

*China's rapid development and urbanization have induced large numbers of rural residents to migrate from their homes in the countryside to urban areas in search of higher wages. It is estimated that there are more than 60 million "left-behind children" (LBC) remaining in the countryside after their parents migrate, typically living with surrogate caregivers. Extensive research has focused on the impact of parental out-migration on children's mental health, but less attention has been paid to the effects of parental return-migration. The present paper examines the changes in mental health before and after the parents of fourth and fifth grade students out-migrate or return-migrate. We draw on a panel dataset collected by the authors of more than 19 000 students from 252 rural primary schools in northwestern China. Using DID and propensity score matching approaches, our results indicate that parental out-migration has a significant negative impact on the mental health of LBC, as they tend to exhibit higher levels of anxiety and lower levels of self-esteem. However, we find that parental return-migration has no significant effect on the mental health of LBC.*

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Key words: left-behind children, mental health, out-migration, return-migration, rural China

JEL codes: I12, O12, O15

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## I. Introduction

Over the past few decades, China's rapid development and urbanization have induced large numbers of rural residents to migrate from their homes in the countryside to urban areas in search of better jobs (Hu *et al.*, 2008; Wen and Lin, 2012; MHRSS, 2013). The majority of the internal migrants leave their children behind in home communities with a surrogate caregiver due to either financial constraints or because of the transient nature of the work in urban areas (Duan and Zhou, 2005; Ye *et al.*, 2006). As a consequence, a new sub-population has emerged in China known as the "left behind children" (LBC) (Duan and Zhou, 2005). In recent decades, the size of this population has increased dramatically. Statistics from the Sixth Population Census show that there were more than 60 million LBC in China in 2010 (ACWF, 2013).

The emergence of LBC has drawn attention from many researchers. While extensive research has been conducted on the effect of migration on the health, nutrition and education of LBC (Gao *et al.*, 2010; Zhou *et al.*, 2015), one of the most prominent parts of the literature seeks to understand the effect that parental migration has on the mental health and emotional well-being of LBC. Research has found the overall prevalence of behavioral and emotional problems among LBC to be as high as 44 percent (Zeng *et al.*, 2009). In general, the literature on the separation of a child from his/her parents shows a positive association between being left behind and mental health problems, including higher rates of depression and anxiety, loneliness and low self-esteem (Gao *et al.*, 2007; Jia and Tian, 2010; Zhao *et al.*, 2014; Zhan *et al.*, 2014; Myerson, 2015). Other research finds that the negative effects are mainly due to the stress that LBC suffer when they are separated from their parents (Li *et al.*, 2015; Wu *et al.*, 2015).

Although previous research has focused on the impact of parental out-migration on children's mental health, less attention has been paid to the effects of parental return-migration. In particular, there is little empirical work that considers whether parental return-migration is capable of reversing or alleviating the effects of out-migration. Given China's strict residency permit system (*hukou*), which only provides individuals access to public and social services in the location of their residency, it is not surprising that large numbers of migrant workers periodically return home to the countryside (Wang and Fan, 2006).

While there is evidence of the trends in return-migration and empirical research teams have established a clear connection between parental out-migration and the outcomes of LBC, to date little research has been conducted on the effects of parental return-migration on the mental well-being of LBC. Wu *et al.* (2015), an exception,

report that children who had previously been left behind but lived with both parents at the time of study tended to experience fewer depressive symptoms. However, Wu *et al.* rely on a single cross-section of data. Therefore, it is difficult to definitively conclude that there is a causal connection between parental return-migration and decreasing symptoms of mental issues among LBC.

In fact, the weaknesses of the empirical literature are not only confined to the return-migration literature: the current literature base that examines the effects of parental out-migration on different mental health outcomes of LBC also often suffers from a number of shortcomings. First, a large number of studies do not have valid comparison groups (e.g. Jia and Tian, 2010; Fan *et al.*, 2010). The absence of a comparison group is often due to the fact that many studies rely on cross-sectional rather than panel data to explore the effects of parental migration (Hu *et al.*, 2014; Zhan *et al.*, 2014). Second, a number of studies are based on relatively small samples. For example, Jia and Tian (2010) examine mental health-related outcomes of LBC with a sample size of only 606 children. Finally, many studies examine single geographic regions, such as single counties, resulting in these studies having weak external validity. Specifically, Jia *et al.* (2010) only examine the situation of LBC in one county in Shandong Province, and He *et al.* (2012) conduct a study in one sub-prefecture level city in Hubei Province.

The overall goal of the present study is to examine the effect of parental out-migration and, in particular, return-migration on the mental health of LBC. To meet this goal, we have three specific objectives. First, we examine the prevalence of parental out-migration and return-migration among households in our sample. Second, we present the correlations between mental health scores and parental out-migration and return-migration. Third, we use difference-in-difference (DID) and propensity score matching approaches to begin to estimate whether there is a causal relationship between parental out-migration (or return-migration) and the mental health of LBC.

## II. Data

The data used in the present paper come from two rounds of surveys conducted by the authors in 2012 and 2013. A total of 19 934 students in 252 elementary schools participated in our survey. In the following subsections, we present the sampling protocol, the data collection method and a description of the study's main variables.

### 1. Sampling

The study's sample is from two areas of western China, Tianshui Prefecture, Gansu

Province and Yulin Prefecture, Shaanxi Province. Gansu Province is the second poorest province in the country (with a per capita GDP of \$3100), while Shaanxi ranked 14th among China's 31 administration regions in 2012 (per capita GDP of \$6108). Tianshui Prefecture is a prefecture with a large number of poor counties in one of China's poorest provinces. In contrast, Yulin Prefecture is a relatively affluent area in a middle-income province. Together, we believe these two prefectures remain broadly representative of the rural areas in China's northwest region.

The next step was to choose the sample schools. To do so, we obtained a complete list of all 435 primary schools in the two prefectures from each county's Bureau of Education. Then, we applied two exclusion criteria to this list of 435 schools. First, we excluded schools with fewer than 50 students in the fourth and fifth grade combined. This was done to safeguard against excessive attrition, as the Chinese Government is currently consolidating existing rural schools into new large centralized schools. Second, we excluded those schools with more than 150 students in the fourth and fifth grade combined, because we were concerned that we would not finish each school's surveys in a single day. After limiting our sample in this manner, we then randomly selected 1 school from each township in each of the counties in both prefectures. Within each school, one class was randomly chosen in both the fourth and fifth grade. We chose to conduct the survey in grades 4 and 5 because students of this age were old enough to be able to fill out their own survey forms, but also young enough to be followed for a sufficient period of time.

Based on these lists, we finally selected 252 schools and 19 934 students to be included in our sample. However, by the end of the study there was some attrition. The attrition was due in part to the research team's inability to follow up with students who had transferred schools or were absent (due to illness or injury) on the day of the follow-up survey (851 students). In addition, some students' surveys could not be used in the analysis due to invalid responses on the mental health questionnaires (975 students) and missing information on the student surveys (1342 students). In total, 3168 students were excluded from our analysis (15.9 percent of our sample). Although the total rate of attrition is high compared to other studies conducted with children in rural China (Mo *et al.*, 2014; Lai *et al.*, 2015), we used statistical imputation to check whether our results suffer from any bias arising from attrition. We find that our results are robust and, therefore, the attrition does not appear to affect our findings. After imputing missing values, 17 635 students were included in our analysis.

## 2. Data Collection

Our research group conducted two waves of survey with fourth or fifth grade students

attending sample schools. The first wave of the survey was a baseline survey in September 2012 at the beginning of the academic school year. The second wave of the survey was an endline survey conducted in May 2013. In each wave of the survey, our enumeration teams completed a student survey with three blocks.

### *Mental Health*

The first block of the survey employed three internationally-recognized psychological scales to measure the mental health of the students. These scales include the mental health test (MHT), a social anxiety scale for children (SASC) and a self-esteem scale (SES). The survey was administrated and proctored by our survey team in the classroom.

The MHT scale primarily measures general anxiety and has been used extensively across China as a measure of mental health on grade school students in urban contexts (Deng *et al.*, 2002). It has a reliability measure of 0.84–0.88 and a retest reliability measure of 0.78–0.86 (Wang, 2011). The test includes 100 yes/no questions, 10 of which are validity questions used to detect whether the student is answering the questions honestly. If the student answers yes to more than 7 of these questions, the test is considered invalid. The remaining 90 points make up a student's MHT score, where a lower score corresponds to lower risk for mental health problems. A total score of 65 or higher indicates a high risk of mental health problems and a need for professional help.

The SASC has been widely used in China and has proved to be reliable and valid in previous research (Zhou and Fan, 2001; Yuan *et al.*, 2012). The SASC is capable of assessing a child's emotional, cognitive and behavior problems associated with social anxiety. The scale is made up of 10 items; each item requires the student to self-rate himself/herself on a three-point scale ranging from "never" to "always." A higher score is indicative of a higher level of social anxiety.

The Rosenberg SES is a brief and unidimensional measure of self-esteem, which has been translated and previously used in China (Song *et al.*, 2011; Wang *et al.*, 2013). According to previous studies, the internal reliability and factor structure of the test are psychometrically sound across many languages, including Mandarin (Wang *et al.*, 2013). The scale is made up of 10 items that require the respondent to self-rate himself/herself on a four-point scale ranging from "strongly agree" to "strongly disagree" with five statements that employ reverse scoring. Scores on the SES range from 0 to 30, where a higher score indicates higher levels of self-esteem.

### *Parental Migration*

The second block of the survey provides data on the key independent variable, parental migration history. This information is derived from the survey questionnaire filled out by

students under the supervision of enumerators. As a way of cross-checking, homeroom teachers were asked to verify the information on parental migration status provided by each student. From this information, we are able to determine the four types of households of interest in this study: New Migrant households (both parents are at home at baseline and at least one parent out-migrated during the period between the baseline and endline surveys), Never Migrant households (both parents are at home at baseline and neither parent out-migrated during the period between the baseline and endline surveys), Return households (both parents migrated at baseline and at least one parent returned home during the period between the baseline and endline surveys) and Never Return households (both parents migrated at baseline and neither parent returned home during the period between the baseline and endline surveys).

#### *Other Covariates*

The third block of the survey collected data on the basic socioeconomic and demographic information of sample students. Because these variables may directly affect mental health, by controlling for them we might be able to more efficiently measure the effects of parental out-migration and return-migration on mental health. Specifically, we collected information on each student's gender, age and grade, whether they are an ethnic minority, and whether they are boarding students. The survey questionnaire also included questions on household characteristics, such as assets,<sup>1</sup> father's level of education, mother's level of education and number of siblings.

### III. Methodology

We use DID and propensity score matching approaches to examine whether parental out-migration and return-migration affect the mental health of LBC. To conduct this analysis, our sample students were divided into two treatment groups and two comparison groups along the lines of out-migration (New Migrant households and Never Migrant households) and return-migration (Return households and Never Return households). These two treatment-comparison sets are analyzed separately.

In terms of our analysis, we first employ a DID approach to test the impact of parental out-migration or return-migration on the mental health outcomes of LBC. Then, we use two matching approaches to check whether our results are robust to our estimation strategy. Finally, we extend the cross-sectional matching estimators to a

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<sup>1</sup>Assets are calculated according to each account of family durable goods multiplied by their prices; then indexes are summed and the logarithm is taken.

longitudinal setting and implement a DID matching estimation approach in an attempt to control for additional unobserved factors.

### 1. Difference-in-Difference Approach

We employ a DID approach to compare the mental health of students in the treatment group before and after their parents out-migrated or return-migrated to students in the respective comparison group. The equation estimated is as follows:

$$\Delta Score_{is} = \alpha + \beta \cdot MIG_{is} + \delta \cdot X_{is} + \gamma \cdot Score_{is,baseline} + \lambda \cdot S_s + \varepsilon_{is}, \quad (1)$$

where the dependent variable,  $\Delta Score_{is}$ , indicates the change in one of the measures of mental health of student  $i$  in school  $s$  between the baseline and the endline.  $MIG_{is}$  is the treatment variable (New Migrant for the out-migration analysis and Return for the return-migration analysis) and  $\beta$  is the parameter of interest. The term  $X_{is}$  is a vector of covariates that are included to capture the characteristics of students and their households, such as gender, age, ethnic minority, grade and number of siblings.  $Score_{is,baseline}$  represents the baseline mental health scores of student  $i$  in school  $s$ . The school effects are captured by  $\lambda$ . We account for the clustered design by constructing Huber–White standard errors clustered at the school level.

### 2. Matching Approaches

In addition to the DID estimator, we used two matching approaches to check whether our results are robust to our choice of estimators. These matching approaches are propensity score matching (PSM) and bias-corrected matching (BCM). PSM allows the analyst to match a student in the treatment group with a similar student from the comparison group. In this study, we use the nearest neighbor matching method with replacement. In our BCM approach, we enforce exact matching by county. Each treatment observation is matched to three control observations within the same county with replacement. Both forms of matching effectively control for continuous differences between our treatment and control households. Therefore, we are able to interpret the difference in each student's mental health outcomes as the effect of parental out-migration or return-migration.

In addition to employing both PSM and BCM strategies, we also employ DID matching (DDM) approaches. This is due to the fact that matching methods can only match observations based upon observable covariates, and, therefore, are not able to account for unobservable covariates. To control for unobservable factors, particularly time-invariant factors, we extend the cross-sectional matching estimator to a longitudinal setting and implement additional DDM estimation for both the PSM and BCM approaches.

## IV. Results

### 1. Prevalence of Out-migrant and Return-migrant Households

Similar to the state of migration in many other rural areas in China (Rozelle *et al.*, 1999), numerous households were already in the migrant labor force in 2012 when we conducted the baseline survey. Of the 17 635 households in our sample, there were 8677 (49.2 percent) households in which at least one parent had out-migrated (Table 1, column 1, row 1). In addition, the number of New Migrant households in our sample rose rapidly during the study period. Among the 8958 households that did not have any migrating parents in 2012 (column 1, row 2), at least one of the parents in 2707 of these households (30.2 percent) entered the migrant labor force between September 2012 and May 2013 (column 2, row 2). Our sample also included a subset of households that did not have any out-migrants during the study period. Specifically, 6251 households (35.4 percent of the total sample) did not have any members migrate in either period (column 3, row 2). This group of households is our Never Migrant sample and provides the comparison group against which we can measure the impact of parental out-migration.

Table 1. Patterns of Out-migration in Sample Households in 2012 and 2013, Gansu and Shaanxi Provinces, China

	Migration status in 2012	Out-migration status in 2013	
	(1)	(2)	(3)
	Number of households in 2012	Any parent migrated	Neither parent migrated
Any parent migrated	8677	6171	2506
Neither parent migrated	8958	2707	6251
Total number of households	17 635	8878	8757

Source: Authors' survey.

Notes: Column (1) = column (2) + column (3). The households in column (2), row 1 are always migrant households. The households in column (3), row 1 are return migrants (or those households in which households had a migrant in 2012 and in 2013 had returned home). These households in row 1 are all dropped from the multivariate analysis of out-migration. Total New Migrant households (or those households in which the parents did not migrate in 2012 and migrated in 2013) are found in column (2), row 2. Never Migrant households are found in column (3), row 2.

Among our sample there were also 2201 households (12.5 percent of the total sample) where both parents had out-migrated at baseline (Table 2). Of these 2201 households, 1071 households (6.1 percent of the total sample) had at least one parent return-migrate in the period between the baseline and endline surveys. This group



of households comprises our Return household sample. In addition, there were 1130 households (6.4 percent of the total sample) in which no parent returned home by the time of the endline survey (column 3, row 2). This group of households is our Never Return sample and provides the comparison group against which we can measure the impact of parental return-migration.

Table 2. Patterns of Return-migration in Sample Households in 2012 and 2013, Gansu and Shaanxi Provinces, China

	Migration status in 2012	Return-migration status in 2013	
	(1) Number of households in 2012	(2) Any parent returned	(3) Neither parent returned
Any parent at home	15 434	2266	13 168
Both parents migrated	2201	1071	1130
Total number of households	17 635	3337	14 298

Source: Authors' survey.

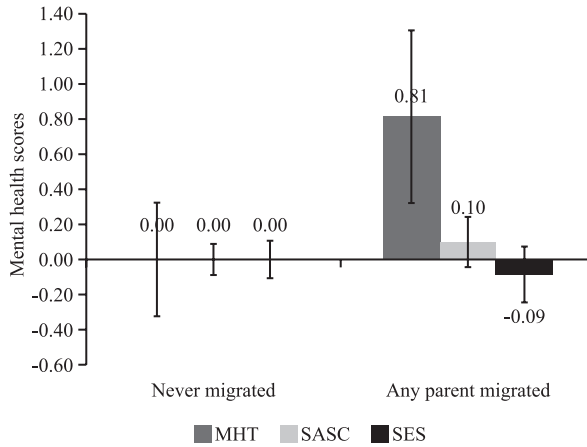
Notes: Column (1) = column (2) + column (3). Total Return households (or those households in which the parents migrated in 2012 and returned home in 2013) are found in column (2), row 2. Never Return households are found in column (3), row 2.

## 2. Correlations between Parental Migration and Mental Health

To determine the correlation between parental out-migration and the mental health of LBC, we compare the changes in mental health scores between students of New Migrant households and Never Migrant households. We find that for children whose parents migrated between the two periods the average MHT score increased by 0.81 standard deviations (significant at the 5-percent level), indicating an increase in general anxiety among sample students. In addition, the average SASC score of students increased by 0.10 standard deviations. At the same time, the average SES score decreased by 0.09 standard deviations. It is important to note, however, that both measures are insignificant and small in magnitude (Figure 1). Generally, these correlations suggest that the mental health of LBC deteriorates after their parents out-migrate.

When we examine how mental health measures differ between LBC from Return households and Never Return households, we find that parental return does not appear to improve the mental health condition of LBC. As depicted in Figure 2, the average MHT score of students increased by 0.09 standard deviations, the average SASC score of students decreased by 0.21 standard deviations, and the average SES score decreased by 0.07 standard deviations. These outcomes suggest that the general anxiety and self-esteem of LBC continue to deteriorate when parents return, although the measure of social anxiety of

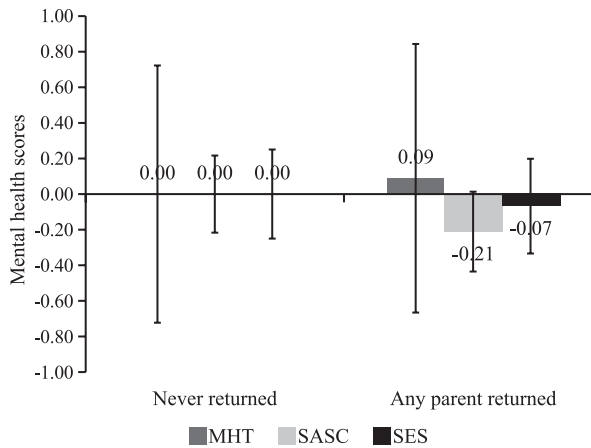
Figure 1. Changes in Mental Health Scores Before and After the Parents of Students Out-migrate with 95 Percent Confidence Interval in Different Migrant Households



Source: Calculated based on author’s survey.

Notes: MHT, mental health test; SASC, social anxiety scale for children; SES, self-esteem scale.

Figure 2. Changes in Mental Health Scores Before and After the Parents of Students Returned Home with 95 Percent Confidence Interval in Different Migrant Households



Source: Calculated based on author’s survey.

Notes: MHT, mental health test; SASC, social anxiety scale for children; SES, self-esteem scale.

LBC improves. However, none of these differences are statistically significant. Therefore, it appears that parental return does not improve the mental health condition of LBC.

### 3. Multivariate Results

The results from the DID analysis reveal that parental out-migration negatively affects

the mental health condition of children when controlling for other factors. Specifically, the MHT and SASC scores of LBC increase by 1.43 and 0.32, respectively (both significant at the 1-percent level), while SES scores decrease by 0.17 (significant at the 10-percent level: Table 3). This means that, everything else held constant, the mental health of children in New Migrant households worsened compared to children of

Table 3. Difference in Difference Regression Results Analyzing the Effects of Out-migration Activities of Parents on Mental Health of Students, Gansu and Shaanxi Provinces, China

Dependent variable: $\Delta Score_i = Score_{i,2013} - Score_{i,2012}$	MHT	SASC	SES
Variables	(1)	(2)	(3)
<i>Treatment variable (MIG<sub>i</sub>)</i>			
Any parent migrated (1 = yes; 0 = no)	1.43*** (0.28)	0.32*** (0.08)	-0.17* (0.10)
<i>Characteristics of the students</i>			
Male (1 = male; 0 = female)	-2.10*** (0.25)	-0.63*** (0.07)	0.10 (0.08)
Age (years)	0.17 (0.15)	0.09** (0.04)	-0.32*** (0.05)
Ethnic minority (1 = yes; 0 = no)	1.30 (1.08)	-0.04 (0.27)	0.43 (0.32)
5th grade (1 = yes; 0 = no)	0.75** (0.37)	0.32*** (0.08)	0.71*** (0.12)
Boarding student (1 = yes; 0 = no)	0.29 (0.49)	0.09 (0.10)	-0.24 (0.14)
<i>Characteristics of the parents and the households</i>			
Log (asset)	-0.13 (0.09)	-0.04* (0.02)	0.07** (0.03)
Father has at least junior high school degree (1 = yes; 0 = no)	-0.15 (0.27)	-0.13* (0.07)	0.36*** (0.09)
Mother has at least junior high school degree (1 = yes; 0 = no)	-0.09 (0.31)	0.00 (0.08)	0.13 (0.10)
Number of siblings	0.02 (0.13)	-0.01 (0.03)	-0.11*** (0.04)
Mental health test score of baseline	-0.44*** (0.01)	-0.62*** (0.01)	-0.54*** (0.01)
School dummy	Yes	Yes	Yes
Constant	16.86*** (1.73)	9.00*** (0.50)	17.93*** (0.65)
Observations	8958	8958	8958
R <sup>2</sup>	0.24	0.32	0.26

Source: Author's survey.

Notes: \*\*\*, \*\* and \* indicate the significance at the 1, 5 and 10-percent level, respectively. Robust standard errors in parentheses clustered at school level. MHT, mental health test; SASC, social anxiety scale for children; SES, self-esteem scale.

Never Migrant households in the period between the baseline and endline surveys. In particular, measures of anxiety provided by the MHT and SASC significantly increased, suggesting that parental outmigration increases the anxiety levels of LBC. In addition, although less significant, the SES scores of LBC decreased over the study period, suggesting that the self-esteem of LBC suffered when their parents out-migrated.

Although there is a clear relationship between parental out-migration and the mental health of LBC, there is no similar relationship exhibited in the case of parental return-migration (Table 4). Although the direction of the effect on the MHT score

Table 4. Difference in Difference Regression Results Analyzing the Effects of Return-migration Activities of Parents on Mental Health of Students, Gansu and Shaanxi Provinces, China

Dependent variable: $\Delta Score_i = Score_{i,2013} - Score_{i,2012}$	MHT	SASC	SES
Variables	(1)	(2)	(3)
<i>Treatment variable (MIG<sub>i</sub>)</i>			
Any parent migrated (1 = yes; 0 = no)	-0.33 (0.60)	0.02 (0.17)	-0.16 (0.19)
<i>Characteristics of the students</i>			
Male (1 = male; 0 = female)	-2.83*** (0.56)	-0.82*** (0.15)	0.06 (0.21)
Age (years)	0.63* (0.32)	0.11 (0.08)	-0.17* (0.10)
Ethnic minority (1 = yes; 0 = no)	0.86 (1.60)	-0.65* (0.38)	-0.19 (0.77)
5th grade (1 = yes; 0 = no)	0.66 (0.69)	0.51*** (0.18)	0.50** (0.21)
Boarding student (1 = yes; 0 = no)	0.96 (1.07)	-0.04 (0.27)	-0.41 (0.32)
<i>Characteristics of the parents and the households</i>			
Log (asset)	0.14 (0.16)	0.01 (0.04)	0.08 (0.06)
Father has at least junior high school degree (1 = yes; 0 = no)	-0.35 (0.56)	-0.11 (0.17)	0.05 (0.18)
Mother has at least junior high school degree (1 = yes; 0 = no)	0.74 (0.63)	-0.14 (0.19)	0.38* (0.21)
Number of siblings	0.43 (0.30)	0.13 (0.08)	-0.04 (0.09)
Mental health test score of baseline	-0.41*** (0.02)	-0.59*** (0.03)	-0.59*** (0.03)
School dummy	Yes	Yes	Yes
Constant	5.47 (3.61)	7.26*** (0.92)	19.31*** (1.47)
Observations	2201	2201	2201
R <sup>2</sup>	0.29	0.37	0.34

Source: Author's survey.

Notes: \*\*\*, \*\* and \* indicate the significance at the 1, 5 and 10-percent level, respectively. Robust standard errors in parentheses clustered at school level. MHT, mental health test; SASC, social anxiety scale for children; SES, self-esteem scale.

of LBC indicates improvement, this result is not statistically significant. Therefore, holding everything else constant, after any parent in a Return household returned home, measures of their children's mental health condition were not significantly different from those of children from Never Return households. This suggests that although parental out-migration may negatively impact children's mental health, parental return-migration cannot correct or offset the damage done to the anxiety and self-esteem of LBC.

The results of the cross-sectional matching analysis support our findings regardless of the matching method used. In the case of parent out-migration, the results of the PSM and BCM approaches reveal that the coefficient on SASC is positive and statistically significant, and the coefficient on SES is negative and statistically significant (Table 5, column 1, rows 1a, 2a and 3a; column 1, rows 1b, 2b and 3b). When PSM and BCM are used to examine the effect of parental return-migration, the coefficients on the three treatment variables are all statistically insignificant (Table 6, column 1, rows 1a, 2a and 3a; column 1, rows 1b, 2b and 3b). In addition, the findings remain largely the same

Table 5. Evaluating the Effect of Parental Out-migration on Mental Health of Students Using Matching and Difference-in-difference Matching, Gansu and Shaanxi Provinces, China

Treatment variables	Matching			Difference-in-difference matching		
	Average treatment effect for the treated	Standard error	<i>t</i> -statistic/ z-value	Average treatment effect for the treated	Standard error	<i>t</i> -statistic/ z-value
MHT						
Any parent migrated						
[1a] Propensity score matching	1.48***	0.45	3.25	1.64***	0.44	3.74
[1b] Bias corrected matching	1.38***	0.32	4.35	0.80**	0.32	2.49
SASC						
Any parent migrated						
[2a] Propensity score matching	0.28**	0.12	2.45	0.38***	0.13	2.98
[2b] Bias corrected matching	0.31***	0.08	3.65	0.08	0.09	0.90
SES						
Any parent migrated						
[3a] Propensity score matching	-0.29**	0.13	-2.19	-0.21	0.15	-1.46
[3b] Bias corrected matching	-0.28***	0.10	-2.74	-0.03	0.11	-0.33

Source: Author's survey.

Notes: Propensity scores are estimated using the same set of covariates as in the difference-in-difference (DID) approach. \*\*\*, \*\* and \* indicate the significance at the 1, 5 and 10-percent level, respectively. *t*-statistics are reported for propensity score matching and *z*-values are reported for bias-corrected matching in parentheses. MHT, mental health test; SASC, social anxiety scale for children; SES, self-esteem scale.

Table 6. Evaluating the Effect of Parental Return-migration on Mental Health of Students Using Matching and Difference-in-difference Matching, Gansu and Shaanxi Provinces, China

Treatment variables	Matching			Difference-in-difference matching		
	Average treatment effect for the treated	Standard error	<i>t</i> -statistic/ z-value	Average treatment effect for the treated	Standard error	<i>t</i> -statistic/ z-value
MHT						
Any parent returned						
[1a] Propensity score matching	0.01	0.84	0.01	-0.28	0.78	-0.36
[1b] Bias corrected matching	-0.02	0.56	-0.03	-0.29	0.60	-0.49
SASC						
Any parent returned						
[2a] Propensity score matching	-0.22	0.21	-1.04	-0.26	0.21	-1.22
[2b] Bias corrected matching	-0.03	0.16	-0.20	-0.12	0.18	-0.64
SES						
Any parent returned						
[3a] Propensity score matching	-0.14	0.26	-0.56	-0.11	0.27	-0.41
[3b] Bias corrected matching	-0.23	0.20	-1.19	-0.14	0.21	-0.69

Source: Author's survey.

Notes: Propensity scores are estimated using the same set of covariates in DID. \*\*\*, \*\* and \* indicate the significance at the 1, 5 and 10-percent level, respectively. *t*-statistics are reported for propensity score matching and z-values are reported for bias-corrected matching in parentheses. We use propensity scores as a tool to enforce a common support. We use the nearest neighbor matching with replacement. Following Smith and Todd (2005), we match students based on the log odds ratio and standard errors are bootstrapped using 1000 replications. To minimize geographic mismatch, we enforce exact matching by county. Each treatment observation is matched to three control observations with replacement. The weighting matrix uses the Mahalanobis metric, which is the inverse of the sample covariance matrix of the matching variables.

when the DDM estimator is used (Table 5, column 4; Table 6, column 4). Therefore, we find that our results are robust regardless of the estimation strategy used.

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## V. Conclusion

In this paper, we attempt to determine the effects of parental out-migration and return-

migration on the mental health of LBC. Our results show that parental out-migration has a negative effect on the mental health of LBC. Specifically, LBC tend to exhibit higher levels of anxiety and lower self-esteem. In addition, we find that parental return-migration has no significant effect on the mental health of LBC. This suggests that although parental out-migration harms the mental health of LBC, parental return cannot offset the effect that out-migration had on a child's anxiety and self-esteem levels. These results persist even though the increased income that is characteristic of migrant households provides these households with the financial capacity to better provide for LBC (Zhou *et al.*, 2015), which could theoretically improve outcomes for this population.

According to our analysis, there might be several reasons for these results. For example, it might be the case that the younger a child is, the stronger their attachment is to their parents. With this understanding, it is conceivable that there is a large negative effect on a child's mental health when parents migrate that cannot be offset right after parents return when the child is older. Another reason may be that the psychological damage of parental out-migration to LBC cannot be corrected in the short run. If this is the case, it explains why we find negative effects of parental out-migration but do not find positive effects of parent return-migration on the mental health of LBC over our study period.

Based on these results, we recommend that policy-makers implement programs that can help support the mental health of LBC after their parents migrate. It is our understanding that such programs could help mitigate the effects of parental migration by providing another source of support or equipping students with the ability to better handle the hardships faced when they are left behind in the countryside. Previously, school counseling has proven to be effective at reducing learning anxiety (Whiston *et al.*, 2011; Wang *et al.*, 2014). Offering similar programs to LBC may hold the potential to help them cope with difficulties and emotional issues.

Our research contributes to the literature on LBC in China in a number of ways. First, our research examines not only the effect of parental out-migration, but also return-migration on mental health outcomes of LBC. Next, our estimation strategy employs panel data from two periods to examine the effect of parental out-migration and return-migration, allowing us to control for time-invariant factors in a way that is not possible using cross-sectional data. Third, we employ a number of robustness checks to corroborate and increase the confidence for our findings.

Although we have used a number of approaches to identify the effects of out-migration and return-migration on the mental health of LBC, it is still possible that our analysis suffers from weaknesses. Our findings are generally robust, but if the

assumptions underlying our methodologies are not valid, then our estimates could be biased. In addition, even though we controlled for many observed and time-invariant unobserved factors, there still might be factors that affect the mental health of LBC that we could not account for in our analysis.

In all, our findings suggest that the mental health of LBC suffers when parents migrate out of the countryside for work and that mental health issues are not fully alleviated if and when their parents return. We believe that this research is an important addition to the literature surrounding the ever-growing population of LBC in China today. In addition, these findings can help develop the evidence on how policy can best be implemented to improve the mental health of this vulnerable population.

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