Does the Absence of Adult Children Migration Influence the Health of Parents Left Behind? The Impact from Rural to Urban Migration in China

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Abstract

This study focuses on those who are left-behind parents. In this research, we use the RUMiC (2008) data set that has individual measures of migrants and their parents to empirically investigate the effect of children's rural-urban migration on the health of the left-behind parents. Based on an endogenous probability model with instrumental variable correction, the main finding is that this research provides empirical evidence that the percentage for health outcomes decrease almost 50 percent if their migrant children do not live with them at all. In other words, under the control of living circumstances, the left-behind parents' health still suffers due to the absence of their migrate children.

JEL Classification: J61, O15, J14, I15

Keywords: living arrangements, aging, health, left behind

1 Introduction

Since late 1979, China experienced the world's largest migration flow from rural to urban areas according to the International Labor Organization. As a result, the urbanization of China grew from 18 percent at 1978 to 53 percent at 2015 according to the World Bank World Development Indicators. Since the internal migration in China accounts for the world's biggest labor flow today, it has begun to attract the world's attention. There have been a large number of studies which investigate migration patterns, and the push and pull theory has been one of the mainstream thoughts (Lewis, 1954；Harris and Todaro, 1970; Sjaastad, 1962; Todaro, 1969, 1976, 1989; Borjas, 1990；Fiona Steele, Elizabeth

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Washbrook Christopher Charlton, Christopher Charlton & William J Browne, 2016). Other studies focus on impact of the migration as remittance (Klaus F. Zimmermann 2016) and happiness of the migrants' household (Massimiliano Tani, 2016; Zhong Zhao, Wang-Sheng Lee, 2015).

However, few studies have focused on the impact of migration on the left-behind parents. During the last several decades, there have been a large numbers of young migrants, and this trend creates a significant population of left-behind parents. Although few studies analyzed the impact of children's migration on the health outcomes of left-behind parents, it may be non-negligible. Migrant children may free themselves from the poverty trap by migration, but to those who are left-behind face various problems emanating from the absence of their children. For example, an outflow of young generations will cause a shortage of agricultural labor in rural areas. Also, it will also cause a shortage of caretakers of old generations. However, these adverse consequences have not been paid attention in the literature as it has mainly focused on the determinants of migration. Furthermore, evidence from studies on the impact of the children's migration regarding left-behind elderly parents has been much limited. Thus, this paper attempts to analyze the causal relationship between migration of adult children and the health of the parents left behind in China.

There are two major challenges when trying to analyze the causal relationship between the adult children migration and the health of left-behind parents. First, the problem of reverse causality should be addressed because it is likely that parents' health influences children's migration decisions. John Giles and Ren Mu (2004) examined how parents' health condition influences their children's decision on migration, and showed that the good health of parents reduces the pressure of their children to stay with them, thereby facilitating their children's migration. However, this causal relationship can be identified only before the migration decision, and once their children migrated, the absence of children is more likely to influence the left-behind parents' health outcomes. Although the new strain of studies aim to identify this causal relationship between the health of left-behind elderly and their adult children migration (see, for example, Démurger and Wang (2016) and Zhao and Jiang (2016), none of them have addressed the causality problem associated with the research timing . In order to address this reverse causality problem and to assure all the children have already left home, this study restricts its dataset to parents and children registered in different households. We define this situation as "post-migration", which is the condition that mitigates the reverse causality problem. To the author's knowledge, this study is the first one that uses the criteria of "post-migration" to deal with the reverse causality.

The second difficulty is the endogeneity problem that typically exists in the migration research. The method mostly used in this field is the Propensity Score Matching and the Instrumental Variables (IV) methods. This research relies mainly on the IV methods to address this endogeneity problem. Firstly, the non-migration households and migration households have several significant differences in China, they are difficult to match with each other. Secondly, this data set has several variables directly related to migration, but may not directly related to parents' health outcomes. Lastly, this research follows the same research methodology of the majority of previous studies on China's internal migration, which used the IV method as the main empirical approach.

On the sides of solving these two difficulties, this research aims to establish a causal relationship between the adult children's migration and the health outcomes of left-behind parents by using the "Longitudinal Survey on Rural Urban Migration in China" (LSRUMC) dataset, which covers with 15,667 households in 29 provinces in China. By using the IV method both for the probit model and linear probability model (LPM), this research provides evidence that adult children migration causes a significant damage on left-behind parents' health outcomes.

This paper is organized as follows. Section 2 introduces the background of this research. A brief discerption of the dataset is given in Section 3, and the empirical methods and results are shown in Section 4. The last section summaries the results of this research and discusses the implication of the findings.

2 Background

This section describes the situation surrounding the left-behind parents. The well-known "One-child Policy" was a part of the Chinese family planning policy, which aimed to control the growing population in China, and has influenced the Chinese family structure in several ways. Before the One-child Policy, there were various policies for population control. The first policy concerning population control was introduced in 1975. The policy to enforced urban couples to have less than two children, and rural couples to have a maximum of three children. In 1978 the Communist Party introduced the One-child Policy, which permitted only one child per couple for the Han ethnic group. However, a significant revision of this policy was made in 1984. Rural couples were allowed to have more than on child as long as they accepted to pay fines. Also, they were allowed to have a second child if their first child was a girl. As a consequence, it became common for a family to have more than one child in rural areas. Therefore, it became possible for the left-behind elderly to live with remaining non-migrating children. This implies that the health status of the left-behind parents is likely to depend on whether a family has one child or more than one child. Thus, the living arrangement is a key factor in the analysis of the left-behind elderly's health status.

In China, it has traditionally been recommended that the grown up children take care of their elderly parents. In addition to the social pressure of filial piety, the Marriage Law of the People's Republic of China established in 2001 states that the children have the duty to take care of their elder parents. This also applies to migrated children, but few can provide adequate support for their left-behind parents if they have migrated to a distant destination. Absence of children's support tends to devastate the physical and mental health of their parents if they are old or sick. Thus, the life status of those left-behind elderly constitutes a significant social problem particularly in rural areas.

Given the trend of the migration, the governments introduced several policies to support the migrants. For example, two were issued in 2002 and 2003, named Document Number 2 of 2002 and Document Number 1 of 2003, to initiate the process to eliminate labor market discrimination against migrant workers and to legitimize the regulations. With the government's continuous effort, the situation of migrant workers has been improved although there are still few policies or documents

considering the left-behind elderly. However, there are still few policies that benefit the left-behind elderly.

3 Data description

This study uses the Longitudinal Survey on Rural Urban Migration in China from the Institute for the Study of Labor, IZA. The previous studies that used this data set focus on three different aspects of migration. The first one is regarding the relationship between remittance and migration. The second one is on the wage gap (Klaus et al. 2016; Rachel et al. 2015; Björn et al. 2014; Hartmut and Yuhao 2013; Klaus et al. 2014; Zhong et al. 2014). The last one concentrated on the well-being of migrants (Wei Huang 2015; Xin Meng and Chikako Yamauchi 2015) or education attendance of migrants' children (Massimiliano Tani 2016).

The Longitudinal Survey on Rural Urban Migration in China (RUMiC) consists of three parts: The Urban Household Survey, Rural Household Survey and Migrant Household Survey. It was initiated by a group of researchers at the Australian National University, the University of Queensland and the Beijing Normal University and was supported by the Institute for the Study of Labor (IZA), which provides the Scientific Use Files. The financial support for RUMiC was obtained from the Australian Research Council, the Australian Agency for International Development (AusAID), the Ford Foundation, IZA and the Chinese Foundation of Social Sciences. The IZA data is a face to face interview data temporal that covered the year of 2008.

This research used The Urban Migrant Survey (UMS) of 2008 that covered 29 provinces of China. The main purpose for this research is to analyze the issue of whether migrants' left-behind parents suffering from worse health outcomes than their counterparts. In this research, the health outcome variable is the self-report-health (SRH) collected from the survey question of "Current health status", and has a range from one to five; one stands for "very good" and five stands for "very poor". For the simplification, the health outcome in this paper defined as "poor health", which marked as 1 for those who claims "very poor" or "poor", 0 for otherwise. The "Migrant children" is been calculated from the question "How many months have you not lived together in the past 12 months?", and "Migrant children" marked as 1 for those who chose zero month, 0 for otherwise. The original sample consist of 15,667 households from UMS and has been restricted to those children over the age of 20, thus totaling 12,279 useful objectives. The reason as to why this research is restricted to adult children whose age is over 20 is to make sure that they are the ones who take care of parents rather than being cared for by parents.

Besides the basic information of parents' individual characteristics of age, education or living circumstances, this survey also contains a question regarding parents' living arrangement. This data gives detailed information of parents' living situation, and we convert the living arrangement into a bivariate variable, "with other" marked as 1 for those who chose "live with other people", 0 for otherwise, "with grand" marked as 1 for those who chose "live with only immature children/grandchild", 0 for otherwise. This allows us to analyze the effect of living arrangement on left-behind parents' health outcomes. In addition, Section 4.4 discusses more detail on how "living arrangement" influences left-

Table 1. Living Arrangement

Living Arrangement	Freq.	Percent
Alone or with spouse	8,394	68.36
With adult children/grandchildren/child	2,734	22.27
With only immature children/grandchild	798	6.5
With other people	264	2.15
In a nursing home	13	0.11
Other	62	0.5
With spouse & grand daughter	13	0.11
With his/her mother	1	0.01
Total	12,279	100

wave 2008

Source: RUMiC Data

Table 2. Statistic Description

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
Poor health	9,859	0.0793184	0.2702488	0	1
Migrant Children	9,859	0.5216553	0.4995562	0	1
Live rural	9,859	0.8685465	0.3379128	0	1
With other	9,859	0.2354194	0.4242822	0	1
Withgrand	9,859	0.066741	0.2495857	0	1
Age60	10,006	0.1858885	0.3890361	0	1
Age70	10,006	0.0963422	0.2950747	0	1
Age80	10,006	0.021587	0.1453381	0	1
Age90	10,006	0.1389167	0.3458768	0	1
Income	9,857	781.0663	1604.151	0	40000
No access	10,006	0.114931	0.3189546	0	1
Nkids	9,859	3.206106	1.466236	1	9
Never attend school	9,858	0.3138568	0.4640825	0	1
Month live without parents	9,859	9.554214	3.867817	0	12
KmtoCity	9,978	28.90712	59.18979	0	3000
KmtoTraffic	9,970	16.10712	59.94585	0	3000
Age of child	10,004	30.76919	8.70552	20	88
Ratio of migrants of hometown	9,881	58.0088	20.14371	0	100
Province	10,006	40.79602	7.909828	11	65

wave 2008

Source: RUMiC Data

Table 3. Data description

VARIABLES	Data Description
Poor health	Poor health status
Migrant children	Have at least one child migrant
Live rural	Living in rural area
With other	Living with siblings
With grand	Living with grandchildren only
Age60	Age over 60
Age70	Age over 70
Age80	Age over 80
Age90	Age over 90
Income	Remittance
No access	Have no access to medical services
Nkids	Number of children
Never attend school	Education level under elementary school
Month live without parents	In past year how many months left parents
Km to City	Kilometers to town
Km to Traffic	Kilometers to station
Age of child	The age of child
Ratio of migrants of hometown	Migration ratio of the hometown
Province	Province code
wave 2008	

Source: RUMiC Data

behind parents' health.

Table 1 presents the statistics of parents' living arrangements. Table 2 displays the statistic description of variables that have been used in this research. The definitions of each variable used in this research are shown in Table 3.

4 Empirical models and results

4.1 Model specification

In order to investigate the influences from adult children migration to left-behind elderly's health outcomes, we begin with the LPM as a simple regression model. In this model, we assume that children's migration status and other characteristics determine parents' health outcomes, and the equation should be written as follows,

$$Health_i = \beta Migrant\ children_i + \gamma' X_i + \varepsilon_i\ , (1)$$

where the dependent variable $Health_i$ is a measure of the parents' health outcome. As descripted above, $Health_i$ is a binary variable which takes value one if the parents are in "poor health".

$Migrant\ child_i$ stands for the absence of migrated children, which takes value one for at least one adult children absence, and zero for otherwise. The vector X_i includes individual characteristics and living conditions of the parents, namely distance to downtowns in kilometers, distance to traffic stations in kilometers, and the number of children. We also include dummy variables for residence in rural areas, living with sibling, living with grandchildren only, age cohorts, the absence of access to medical care, lack of school attendance experience, and years of education (5-year, 6-year, 9-year, and 11-year). Since the dependent variable is a binary variable, we also shown the results of probit model in the results section.

This dataset contains both parents with non-migrant children and parents with migrant children. The absence of those non-migrant children is considered as the absence from home less than one year for marriage or moving out for independence. Those migrant children are regarded as leaving home more than one year for work.

Although our analysis so far has treated the migration decision as exogenous, the migration decision may be made in consideration of the parents' health. Even though there may exist some unobserved variables that may influence the behavior of migration, such as an inherited illness. As a consequence, the estimated parameters from the simple LPM may be biased due to the endogeneity of the migration decision. Accordingly, we introduce the IV method to deal with this bias. The dataset also includes information of the migrants themselves and their rural hometown background. We use variables of "children's age", and "ratio of migrants of hometown" (Migration ratio of the hometown in percentage) as the instrumental variables to "migration". The "ratio of migrants of hometown" is thought to have no direct influence on the parents' health, but to be related to the children's migration decision. Also, the "age of child" is thought to be an individual specific variable which influences children's decision of migration since the young are more likely to migrate. The IV model is specified as follows:

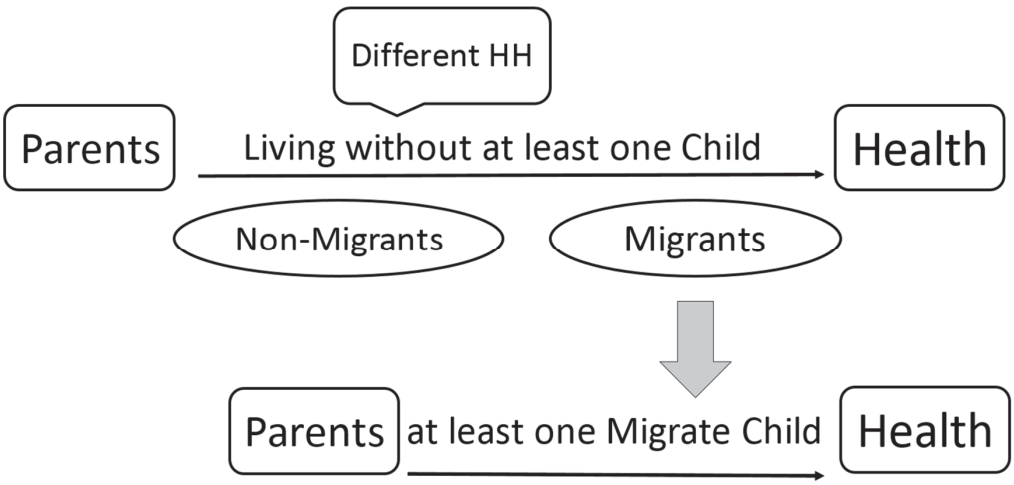

Figure 1. The influences from adult children migration to left-behind parents' health outcome

$$Migrant\ children_i = \pi' Z_i + \theta' X_i + \varepsilon_i \text{ , (2)}$$

where $Migrant\ child_i$ is the endogenous variable, Z_i is a vector of the instrumental variables. X_i is the vector of parents' individual characteristics and parents' living circumstance variables. The relationship between the key variables in the IV model is displayed in Figure 1.

To support the IV strategy, we ran a falsification test in the robust check section, and proved that those two instruments do not directly affect parents' health status.

4.2 The results

The results of the probit model and LPM presented in Table 4. Noted, the probit model only shows the marginal effect. Consistently, Table 5 provides the results of instrumental variable in the probit Model (IV-probit) and instrumental variable in the linear probability model (IV-LPM).

From Tables 4 and 5, the parents who have migrant children in their family have devastated health outcomes. In Table 4, the coefficient for "migrant children" is around 0.24, on the contrary, the effect of "migrant children" rises up to 0.56 if IV method is employed.

Table 4. Marginal effect of probit model and LPM model

	probit	LPM
VARIABLES	Poor health	Poor health
Migrant Children	0.0258***	0.0225***
	(0.0572)	(0.00705)
Controls	yes	yes
Constant	-1.838***	0.0215
	(0.142)	(0.0175)
Observations	9,818	9,818

Note: Figures in parentheses are *t* statistics.
"***", "**" and "*" denote significance at the 1%, 5% and 10% levels, respectively.

Table 5. Marginal effect of IV-LPM and IV-probit

	IV-LPM(2)	IV-probit
VARIABLES	Poor health	Poor health
Migrant Children	0.56**	0.4654242***
	(0.00944)	(0.0300951)
Controls	yes	yes
Constant	0.227	-0.706***
	(0.300)	(0.00447)
Observations	9,700	9,700

Note: Figures in parentheses are *t* statistics.
"***", "**" and "*" denote significance at the 1%, 5% and 10% levels, respectively.

4.3 Robustness check

In order to show that our results are robust, we run several tests to confirm the sign of the effect and the causal direction as well as legitimacy of the IV estimation.

For the IV methodology, we first tested the endogenoeity of "migrant children". Table 6 gives the results of the endogenoeity test after IV-LMP with the related robustified Durbin-Wu-Hausman (DWH) test. The result of the Wald test of endogenoeity for the IV-probit model is shown in Table 7. The results of the endogenoeity test in Tables 6 and Table 7 show that the null hypothesis that "migrate children" is exogenous is rejected with a high significance. Therefore, the results support that the IV Model is appropriate. Second, we test the validity of the instruments. For IV-LMP, the test of weak instruments is shown in Table 8. Since we have more than one instrument, Table 9 gives the result of the over-identifying restriction test. In addition, Table 10 shows the results of the reduced sample of parents with only non-migrant children, and the results support that without the effect of "migrant children", the two instruments, "age of child" and "ratio of migrants of hometown", have no direct influence on the outcome of left-behind parents' health.

Table 6. Endogeneity test for IV-LPM

Tests of endogeneity		
Ho: variables are exogenous		
Robust score chi2(1)	= 20.8438	(p = 0.0000)
Robust regression F(1,9681)	= 20.8998	(p = 0.0000)

Table 7. Endogeneity test for IV-probit

Wald test of exogeneity (/athrho = 0): for IV-probit		
Ho: variables are exogenous		
chi2(1)	= 25.10	(p>chi2 = 0.0000)

Table 8. First-stage regression summary statistics for IV-LPM

VARIABLES	R-sq.	Adjusted R-sq.	Partial R-sq.	Robust F(2,7360)	Prob > F
Migrate children	0.0242	0.0224	0.0026	12.2694	0.0000

Table 8 shows the test of weak instruments with the first-stage summary statistics. The results reject the null hypothesis in that instruments are weak because the F statistic score is 12.27.

Table 9. Over-identifying test for IV-LPM

Test of overidentifying restrictions: 2SLS with robust VCE		
Null hypothesis : Over identifying restrictions are valid		
Score chi2(1)	2.19338	(p =0.1386)

Though the instruments cannot be tested in a just-identified model, here we test the validity of instruments by the test of over-identifying restriction. From Table 9, the results cannot reject the null hypothesis that all instruments are valid. Thus, we conclude that the over-identifying restriction is valid.

In the above explanation of the empirical methodology, we provide the reason why we choose "age of child" and "ratio of migrants of hometown" as instruments, and showed evidence from the test that supports the IV estimation. However, there still remains a question as to whether these instruments influence parents' health outcome. Accordingly, an additional robust check for the validity of instruments by using a reduced sample shown in Table 10. This reduced the sample size as the samples have been restricted to those parents who only have non-migrant children, leaving us with only 480 parents. Then, we include "age of child" and "ratio of migrants of hometown" directly in the LMP model as additional explanatory variables. In the reduced sample, since "age of child" and "ratio of migrants of hometown" both show non statistical significance in the model, this two instruments are said not to influence parent's health directly.

Table 10. Results on the reduced sample of parents only have non-migrant children

VARIABLES	Poor health
Ratio of migrants of hometown	0.0001523
	(0.0006558)
Age of child	0.0027262
	(0.0019588)
Constant	-0.2244884*
	(0.09201)
Observations	480
R-squared	0.0353

Note: Figures in parentheses are *t* statistics.
"***", "**" and "*" denote significance at the 1%, 5% and 10% levels, respectively.

Although we address the importance of the timing of children's migration in the analysis of left-behind parents' health outcome, it is not clear whether the IV estimation can or cannot solve this reverse problem, such as parents in good health whose migrant children will not come back home. Also, instrument validity in order to address the appropriateness of "age of child" as an instrument, we use two alternative methodologies to confirm that our earlier result still holds.

One alternative method for IV-LMP is the bivariate probit model (BPM). This methodology follows the seemingly unrelated regression (SUR) framework, where two equations are correlated for defined individual but not across different individuals. For the details, in the BPM, the error terms of the two probit models in the equation system are correlated., Given that we cannot obtain the marginal effect from the BPM in our study, Table 11 delivers the results based on the extent to which the left-behind parent's health status changes if adult children migrated. The result shows that, if an adult children migrated, the parent's health will reduce 0.4 points, which is similar to the IV-LMP result. In addition,

after the BPM, we check the correlation between the "poor health" and "migrant children", and gained the results of 0.03, which is a very weak positive correlation. Therefore, we conclude that our instrumental variables do not directly influence the depended variable.

Another alternative method for IV-LMP is the treatment effect model (Cameron and Trivedi 2010).This methodology has the advantage of accommodating the endogenous treatment variable (in this case, migration) while allowing for the correlation of the unobservable factors in both the selection and outcome equations. Table 12 presents the treatment effect results. The number reduces to 0.36 points from 0.56 points in IV-LPM, but still shows that "migrate children" has a statistically significant negative effect on parent's health.

Table 11. Marginal effects from bivariate probit model

VARIABLES	Poor health
Migrant Children	0.0374231 *
Controls	yes
Observations	9698

Note: Figures in parentheses are *t* statistics.
"***", "**" and "*" denote significance at the 1%, 5% and 10% levels, respectively.

Table 12. Results from linear regression with endogenous treatment

VARIABLES	Two-step	Maximum likelihood
Migrant Children	0.3583365***	0.1927186**
	(0.0746321)	(0.0598629)
Observations	9698	9698

Note: Figures in parentheses are *t* statistics.
"***", "**" and "*" denote significance at the 1%, 5% and 10% levels, respectively.

4.4 The effects of living arrangements on the left-behind elderly's health

In order to highlight the impact from adult children migration on left-behind parents' health in China, we now focus on the differences between left-behind parents who live alone, and those who live with other offspring. As we addressed before, this RUMiC data set contains information of living arrangements of the parents, which allows us to compare different sub-samples. In the group of parents who "live alone", those who choose "alone or with spouse" are included. In contrast, the group of parents who "live with other offspring" were created from those who choose "with adult children/ grandchildren/child". Figure 2 depicts the structure of this extended analysis.

We continue using the IV-LPM. The IV-LPM estimation is conducted for each of these two groups. The results are shown in Table 13.

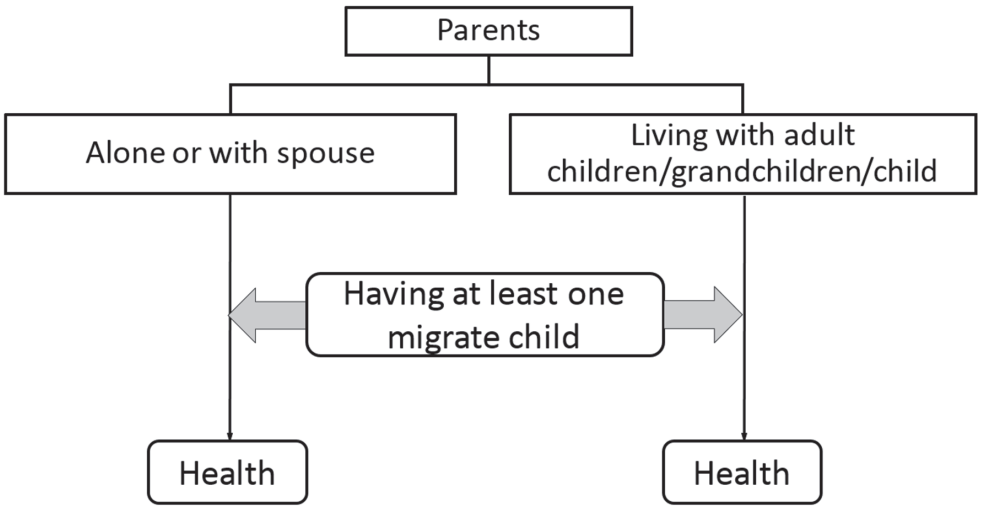

Figure 2. The effects of living arrangements on left-behind parents' health outcome

Table 13. Comparison between parents who live alone and parents who live with other offspring

VARIABLES	Poor health (Alone)	Poor health (With other offspring)
Migrant Children	0.621**	0.441**
	(0.250)	(0.220)
Constant	-0.222**	-0.0925
	(0.0925)	(0.105)
Control	yes	yes
Observations	6,483	2,287

Note: Figures in parentheses are *t* statistics.
"***", "**" and "*" denote significance at the 1%, 5% and 10% levels, respectively.

Comparing these two groups indicates that parents who live alone or with a spouse suffer more from the absence of their migrant children than those who live with other offspring. Table 14 highlights the differences between the parents who live alone, and those who live with their other offspring.

5 Conclusion and discussion

This research mainly discussed the causal relationship between the adult children migration and the left-behind parents' health outcome, and shows similar results with the prior ones that were conducted by Antman (2010) regarding international migration from Mexico to the U.S., in that migrant children do not live with their parents have a negative effect on their parents' health. The contribution of this research is that it address the timing of the analysis, and the possibility of the reverse causality. The

result suggests that parents suffer from health problem due to the absence of their migrant children. The results also show that, without access to hospital services, it will reduce parents' health outcome. Also, we compared the parents who live alone with those who live with other offspring, and found that parents who live alone suffer more than their counterparts.

In addition, these results generally suggest that the merit of the internal migration may have built on the sacrifices of the left-behind elderly even though the migration from rural-to-urban in these years dedicates a large labor supplement to industry development and leads to substantial success in China. Therefore, it is crucial to build a policy which can ease the health problems caused by young people's migration.

However, this paper still leaves room for further studies. This research used self-reported health status as the measurement for health status. Future studies will benefit from additional information such as physical health status by using data such as weight, height, or the frequency of hospital/clinic visits. For the analysis on mental health status, future studies can explore various factors such as mental pressure, loneliness and life satisfaction.

References

Brown, L.A., Moore, E.G. (1970). "The intra-urban migration process: a perspective." *Geogr. Ann. B* 52, pp. 1-13.

Connelly, R., & Maurer-Fazio, M. (2016). Left behind, at-risk, and vulnerable elders in rural China. China Economic Review, 37, 140-153.Dorigo, G., and Tobler, W. (1983). Push-Pull Migration Laws. *Annals of the Association of American Geographers,73*(1), 1-17.

Fan, C. C. (2005). Modeling interprovincial migration in China, 1985-2000. *Eurasian Geography and Economics*, 46(3), 165-184.

Fan, C. C. (2005). Interprovincial migration, population redistribution, and regional development in China: 1990 and 2000 census comparisons. *The Professional Geographer*, 57(2), 295-311.

Francisca M. Antman, Brian Duncan and Stephen J. Trejo (2016) "Ethnic Attrition and the Observed Health of Later Generation Mexican Americans" (with). *American Economic Review*, 106(5): 467-71, May 2016. (Papers and proceedings issue.)

Francisca M. Antman (2013) "The Impact of Migration on Family Left Behind." *In International Handbook on the Economics of Migration*, A.F. Constant and K.F. Zimmermann eds., Edward Elgar: Northampton, MA, 2013. NB: Includes simulation results from previous work entitled "Who Cares for the Elderly? Intrafamily Resource Allocation and Migration in Mexico."

Francisca M. Antman (2011) "International Migration and Gender Discrimination among Children Left Behind." *American Economic Review*, 101(3): 645-49, May 2011. (Papers and proceedings issue.)

Francisca M. Antman (2010) "Adult Child Migration and the Health of Elderly Parents Left Behind in Mexico." *American Economic Review*, 100(2): 205-208, May 2010. (Papers and proceedings issue.)

Frank Qu, Z., and Zhao, Z. (2014). Evolution of the Chinese rural-urban migrant labor market from

2002 to 2007. *China Agricultural Economic Review*, *6*(2), 316-334.

Institute for the Study of Labor (IZA), Australian National University, the University of Queensland and the Beijing Normal University (2014), Longitudinal Survey on Rural Urban Migration in China (RUMiC) (2008 years of). IDSC of IZA. http://dx.doi.org/ 10.15185/izadp.7680.1

Lee, B. H., and Waddell, P. (2010). Residential mobility and location choice: a nested logit model with sampling of alternatives. *Transportation*, 37(4), 587-601.

Massey, D., Arango, J., Hugo, G., Kouaouci, A., Pellegrino, A., and Taylor, J. (1993). Theories of International Migration: A Review and Appraisal. *Population and Development Review*, 19(3), 431-466.

Rozelle, S., Taylor, J. E., and deBrauw, A.. (1999). Migration, Remittances, and Agricultural Productivity in China. *The American Economic Review*, *89*(2), 287–291.

Shuming Bao, Örn B. Bodvarsson, Jack W. Hou, Yaohui Zhao(2007). Interprovincial Migration in China: The Effects of Investment and Migrant Networks. *Chinese Economy*, *42* (4), 7-29.

Taylor, J. E., Rozelle, S., and De Brauw, A. (2003). Migration and Incomes in Source Communities: A New Economics of Migration Perspective from China. *Economic Development & Cultural Change*, 52(1), 75-101.

Zhang, K. H., and Shunfeng, S. O. N. G. (2003). Rural–urban migration and urbanization in China: Evidence from time-series and cross-section analyses. *China Economic Review*, *14*(4), 386-400.

Zhao, Y.. (1999). Leaving the Countryside: Rural-To-Urban Migration Decisions in China. *The American Economic Review*, *89*(2), 281–286.

Zhao, Y.. (1999). Labor Migration and Earnings Differences: The Case of Rural China. *Economic Development and Cultural Change, 47*(4), 767–782.

Zhao, Yaohui (2003). The Role of Migrant Networks in Labor Migration: The Case of China. *Contemporary Economic Policy* **21** (4): 500–511.

Appendix

The health status of parents of non-migrants group and migrant group

Variable	Obs	Mean	Std. Dev.	Min	Max
poorhealth(non-migrant)	487	0.0965092	0.295592	0	1
poorhealth(migrant)	9,372	0.0784251	0.2688537	0	1

IV-LPM full results in 2SLS

VARIABLES	Poor health
Migrant children	0.561***
	(0.169)
liverural	-0.0113
	(0.0115)
withother	0.00826
	(0.00999)
withgrand	0.0394**
	(0.0167)
age60	-0.00896
	(0.0167)
age70	0.0520***
	(0.0182)
age80	0.0529
	(0.0328)
age90	-0.0711***
	(0.0243)
noaccess	0.0369***
	(0.0133)
Nkids	-0.00231
	(0.00529)
neverschool	0.00400
	(0.0376)
ed5	-0.0119
	(0.0361)
ed6	-0.0196
	(0.0345)
ed9	-0.0421
	(0.0361)
ed11	-0.00355
	(0.0377)
KmtoCity	-2.56e-06
	(9.85e-05)
KmtoTraffic	0.000167
	(0.000104)
Constant	-0.187***
	(0.0630)
Observations	9,700