The Effect of Parental Migration on Children: The Case of China

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Abstract

This thesis set out to study domestic migration and child development in China and focuses on the parental migration effect on children. The migration effect is observed from two locations, the destination location where parents and children migrate together, and the source location where parents work away and children are left behind. Children's education and health outcomes are investigated under different parental migration effects. The empirical strategy is using IV estimations. Chapter 1 introduces the research on migration and overviews the thesis. Chapter 2 studies children's test performance at the destination location and finds that migrant children perform weakly relative to local children, and the adaptation costs of the migrants do not fall over time to make any positive impact. Chapter 3 traces back to the source location and studies children's educational outcomes. We find that migration, though intended to improve the households' income and welfare, does inflict short-run costs on the household, some of which are reflected on the child's education. Chapter 4 examines children's health outcomes from physical, mental, and general perspectives at the source location. The results suggest that left-behind children are likely to be malnutrition due to the poor economic condition; they also mentally suffer the separation and limited contacts with parents and tend to report themselves as not healthy. Chapter 5 concludes and makes policy recommendations in corresponding with all problems found in our empirical studies of parental migration.

Declaration

The material contained in this thesis has not been submitted in support of an application for another degree or qualification in this or any other institution.

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Chapter 1

Introduction

1.1 Research Background

Whilst migration has been studied extensively in various fields – such as geography, demography, sociology, and economics – current global circumstances Brexit and the refugee crisis has led to a wider focus on migration issues. Most researches focus on international migration, where most people migrate from developing countries to industrialized countries, otherwise known as South-North migration. United Nations Population Division and the World Bank have provided a precise measurement of global population movement, showing that about 3% of the world's population lived in a place where they not originally born. In 2015, the number of international migrants was estimated at around 244 million, with numbers of a larger significance noticed in many heavily populated areas such as large cities. For instance, in central London, 41% of the total population is foreign-born (2015 data, McNeill, 2017) whilst New York has the foreign-born population of 36.8% and Los Angeles has one of

35.6% (2010 data, World Cities Culture Report 2014).

Instead of cross-country migrating, some people migrate regionally within the boundaries of their own country, which is called internal (or domestic) migration. Most domestic migrants move from rural or undeveloped areas to urban areas or ones with better economic conditions. World Migration Report (2018) identifies approximately 740 million people as domestic migrants. The rate of domestic migration already eclipses the rate of international migration and continues to rise steadily give various global circumstances. (Bell and Muhidin, 2009).

Both international and domestic migration contains incentives or conditions. A country or region's immigration policy is the first and most significant factor. For instance, the EU rules (Maastricht Treaty) entitle all EU citizens and their family members the right to move and reside freely within the European Union. Almost 78% of working-age EU citizens reside in a different European country to the one of which they were born, which is usually more active economically and with a higher employment rate. On average, these migrants benefit from an income which is 3.5% higher than that of their county of birth (European Commission, 2014). Whilst the EU has a more relaxed approach to immigration, most Asian countries implement strict immigration laws – some of the strictest in the world. South Korea only allows low-skilled workers in temporary positions and the situation is often dangerous and difficult, with very few opportunities to become a citizen. To reduce the number of immigrants, Japan offers 3,000 US dollars to unemployed Latin American immigrants and 2,000 US dollars to their dependents, on the condition of leave and never return to Japan (IOM, 2018).

Migration is also a cautious decision for both the individual and the household. Migrants and family members may reap some benefits, they also must be aware of potential costs. Immigrants must calculate whether they will still be benefiting profitably after various fees such as transportation and living expenses, even with a potentially higher income. Also, they must consider the opportunity cost and whether they will benefit from further career development or higher living standards for their family. However, improving the quality of life does not mean the happiness of life is enhanced. The World Happiness Report (2018) provides an overview and evaluation of migrants' happiness levels, concluding that those who move to happier places than their places if origin gain in happiness, while those who move to unhappier places tend to lose. At most destination locations, the migrants' happiness is highly dependent on working pressure and local acceptance from natives.

The analysis of migrant characteristics has concluded that skill levels are independent of race and common themes depending on the place of origin are rare. For people with few educational qualifications, working in jobs that do not require special knowledge, or in low-wage positions are classed within "low-skilled" labour positions; their purpose of migration is to seek a higher income and a better living environment. Working professionals in specific areas or those with a higher educational background are considered "high-skilled"; the majority of these migrants are classed as STEM workers – scientific, technical, engineering, and high-level management workers. This group's migration purpose is to seek opportunities where they can advance and apply their skills. Furthermore, high-skilled labour has become one of the most important

aspects in promoting a country's development.

There are two distinct terms which can be applied to migration: temporary and permanent migration. If people only migrate for a short-term (3 to 12 months) without changing their residency status at the destination location, and later return to the place of origin, it is considered temporary migration and these people are classed as "return migrants". If migrants never return to their source location and to remain in the destination location with a new identity, it is considered permanent migration; this is usually the case if a migrant remains their new location for a year or longer. Apparently, if a person visits a location for recreation; holiday; visits friends or relatives; business; medical treatment; or religious pilgrimages, he/she is not considered as a migrant (United Nation, 1998).

1.2 Economic Research on Labour Migration

The economic research on labour migration can be traced back to classical economics period. The founder William Petty (1690) proposes the "political arithmetic" and finds that the comparative income interest induces agriculture labour flowing to the non-agriculture sector. Adam Smith (1776) studies business contacts and labour division. He believes that the closer tied relationship between rural and urban area is a natural result from the market expansion. David Ricardo (1817) and Friedrich List (1841) use a simple model to illustrate the linkage between agriculture and industry. Clark (1940) points out that with a country's economic

development, labour migration follows the process that firstly transferring from the primary industry to the secondary industry, and then to the tertiary industry.

The full establishment of labour migration theoretical framework is derived from development economics. After World War II, migration study is no longer exclusive to demographers and sociologists, but economists such as Lewis (1954), Fei & Ranis (1961), Jorgenson (1961), and Schultz (1964) study various economic mechanisms, incentives, and factors in labour migration among developing countries. Harris and Todaro (1970) analyse the migration impact from both rural and urban areas. Stark (1991) proposes a relative deprivation hypothesis that illustrates the social characteristics of individual migration behaviour. Table 1.1 concludes the labour migration models in economics.

One would be expected to associate with labour migration is children's human capital investment. Though human capital investment evolves differently through periods in our life-cycle, and it is the childhood that has been increased more rapid and been proved the longest-lasting life-long effects than any other periods (Becker, 1993). Thus, the benefit of investment in the early childhood is far above the benefit in the following adolescence years and thereby increases ones' adult productivity in all tasks, though possibly differentially in different tasks, organizations, and situations.

A significant outcome that affects children's human capital is the remittance, which refers to a transfer of money by a migrant to an individual or a household in their place of origin. At

the beginning of the 21st century, remittance has accounted for the second-largest source of funding for the developing countries and the figures continue to increase at a steady rate. World Bank records show that global remittances have grown 7% from 573 billion US dollar in 2016 to a record level of 613 billion US dollar in 2017. This is more significant than the Official Development Assistance (ODA) and more stable than private capital flows. From a micro perspective, a remittance could relax the household budget with the extra income enabling an increase in health investment and improvement to children's school attendance. Moreover, remittance also refers to social remittance – the ideas, behaviours, identities, and social capital flow from the destination location to the source location (Levitt, 1998). Migrants not only provide financial support to their original households but also bring back new information or advanced knowledge to the left-behind family members.

However, the other outcome is that labour migration restricts parents' time on companionship with the child. Migrating parents may decide whether to leave family members behind at the source location or to take them to the destination location; either of these options could be by choice (voluntary) or due to untenable circumstances (forced). In developing countries, a large number of children are affected by the population movement. Some examples include: Bangladesh, where 18% to 40% of children; Tanzania, where 50% to 60% of children; and Mali, where 80% of children are affected (c.f. Whitehead and Hashim, 2005). Living in a family with at least one parent absent for a prolonged period is a common childhood experience in developing countries (Noble, 2013). Roughly one million children in Indonesia and half a million children in Thailand have been left behind (Bryant, 2005); a majority of

village populations in eastern India consist of left-behind wives and children (Roy, 2015). Alternatively, some households take their children with them, such as in India, where 4 to 6 million children migrate seasonally with their parents (ILO and UCW, 2010).

There is an additional channel discussing migration effects using the "brain gain" theory. Docquier and Rapoport (2012) summarise the basic idea that: the decision that an individual made to invest in human capital will react to the prospect of future migration, yet not all individuals who have chosen to increase their education will eventually migrate. Thus it is crucial that parents have a decent educational background or the knowledge of human capital investment on their children (Gang and Zimmermann, 2000), and the evidence has been found from different countries. Boucher et al. (2009) find that a high international migration rate in Mexico has no significant impact on health investment for people who have not decided to migrate; while de Brauw and Giles (2016) studies the domestic migration in China and find that the high school enrolment rate falls if schools located in a popular out-migration area.

Thus, two issues need to be considered when a child lives in a household with migrants. The first issue is the children's education. The child's relative schooling performance may vary depending on where he/she is studying. At the source location when parents work away, children's performance may appear superior relative to the non-migrants' children because of the remittance as an extra income to invest in education. At the destination location when the whole family migrates, the performance may be inversed due to the access to good schools or educational facilities. The other issue is the children's health, which can be discussed from

physical and mental perspectives. The children's physical health may be improved if they are able to consume a nutritious diet or learn advanced health knowledge; however, these children have to bear the parents' absence if they are left behind, or they need to face more difficulties in adapting to a new environment and under much more academic pressure if they migrate together.

Therefore, it is necessary to observe the effect of parental migration on children at both the source location and the destination location. Besides, migrants' or households' economic behaviours can be different at these two locations. For instance, observing at source location allows us to figure out whether migrants are able to make additional investments (conditional on remittances) and how they invest, while at the destination location, the observing concentrates on whether the migrant households have to incur relocation costs and whether they reduce the scope for spending on children's education or health. Both are the trade-off that the non-migrant does not have to face.

1.3 Migration in China

Over the last forty years, China has transformed itself from a planned economy to a vibrant market economy. During this period China's labour mobility and employment structure have considerably changed. The number of migrants moves from rural to urban areas have surged to the highest level among all developing countries (Zhang and Song, 2003). In 2015, the

migrant population in China had increased to 247 million (China Statistical Yearbook, 2015).

Despite the huge population, China is also one of the countries implementing the strictest immigration policies, both for international migrants and domestic migrants. For a foreign citizen who wishes to obtain Chinese citizenship, he/she must be either a relative of Chinese citizens or permanently residing in China; for anyone who holds the Chinese citizenship, he/she must register to a unique household registration system, hukou system, which is recorded by the central government. Hukou system classifies citizens into an agricultural or non-agricultural hukou, commonly referring as rural or urban hukou, and further categorized by the location of origin (People's Republic of China Hukou Registration Regulation, 1958). It has fundamentally affected all aspects of Chinese citizens' lives such as job position, school enrolment, and medical facilities (see Appendix 1.1 for a more detailed explanation).

Domestic migration in China has been tightly controlled by the central government and highly related to the hukou system; only in the past few decades have these restrictions been loosened. A reform of the hukou system was announced in 2014, which included a provision that eliminated the division between agricultural and non-agricultural hukou types. However, the implementation of this reform is still at a very early stage, and yet, a large number of migrants are restricted by the hukou system. When the household migrates together at the destination location, it is likely that the parents would choose to migrate to the areas that have better public schools and health facilities (Gould et al., 2004). However, without a local hukou account, the migrant children face difficulties of access to public education or qualified facilities (see

Appendix 1.2 for China educational provision for migrants).

Some other parents leave their children or other family members behind at the source location so that to some extent allowing them to minimise the migration cost and avoid the restricted access problem to children. Thus, it is expected that migrant parents will send the remittances and the remittance will enhance the health and educational investment in their children (Zhan et al. 2014). Even though, the problem of parents' absence still cannot be avoided that left-behind children are lack of parents' supervision and encouragement; moreover, the reduction of household core members may increase children's responsibilities to assist and support the family, which is hard for these children to remain in school (Hanson and Woodruff, 2003; Acosta, 2006). When both parents work away, the extended family plays a major role in providing mutual help to left-behind children (Baland et al., 2016). The children living in the same extended family tend to have similar educational performance based on the theory of sibling chain of educational assistance (Simons, 1994), which raises the importance of extended family and the peer effect of living-together siblings.

In addition to the educational performance, researchers recently pay more attention to the health outcome, as health is a complementary subject to education. Multiple indicators such as infant mortality, weight-for-age, height-for-age, and body mass index have been used to measure children's health. Most studies find the migration and especially the remittance shows a positive impact on the children's physical health; however, there are always some social costs reflecting on left-behind children's mental health. The absence of one parent in the

family can cause naturally and psychologically insecurity, resulting in adding more pressures and duties on the other parent staying in the original household. When both parents migrate, it is even worse that children themselves need to undertake all family responsibilities, which is overloaded and far beyond what they should do at a young age. Though left-behind children have been looked after by the extended family, they also suffer from this complex family relationship. Negatives effects from the migrant parents may be significant, but most of these children keep contacts with their parents, rather than left behind as orphans.

1.4 Empirical Problems and Solutions in Migration Studies

The primary problem existing in empirical studies of migration is that migration itself is endogenous. Since migration is generally not a random selection but a cautious decision for the family, it correlates with the same factors that influence both migrants and children. Gibson et al. (2013) conclude four selection problems inherent in most migration studies: i) how households select into migration; ii) why households choose whether to migrate together or left member(s) behind; iii) why some migrants choose to return home; iv) when migrants choose to return. It is hard to determine whether migration has affected the outcome of our interest or some other variables that have correlated with both migration and the outcome. Thus, a classic omitted variable problem exists.

In one situation, if pre-migration preparation is highly costed, the family that is social-

economically wealthy can afford to migrate as well as to pay for children's education at the same time (Kuhn, 2006). A cross-sectional comparison between non-migrant households and migrant households would point out the effect of higher socio-economic status instead of the effect of the actual migration. However, using cross-sectional data raises the opposite causation problem in the observational studies; the migration occurs before the collection of the data and becomes vague to tell if the household circumstances precipitated the migration or the other way around. Some researchers use propensity score matching methods (Alaimo, 2006; Kuhn et al., 2011), which constructs a statistical comparison group that is based on a model of the probability of selection in the migration using observed characteristics. However, propensity score matching assumes no selection bias based on unobserved characteristics, which is still vulnerable to the omitted variable problem.

Another data-based approach is to use balanced longitudinal data. Once the data is available to researchers and outcomes are observable before and after the migration, more solutions are available such as fixed-effects estimators, difference-in-difference estimations, and regression discontinuity design. Though we have sufficient evidence of the advantages of longitudinal data, we cannot ignore that these methods are only helpful if the omitted variable is considered to be time-invariant at the individual or household level (Edmonds, 2006; Antman, 2011). For instance, if we consider the migration cost again, an unexpected boost to a household's socio-economic status can better financially support members' migration and children's human capital investment; but if such boost is unobservable to researchers, the conclusion can be falsely drawn as the migration has improved children's outcomes rather than a positive

economic shock.

Given the difficulties within both cross-sectional and longitudinal approaches, researchers have adopted the instrument variable (IV) estimators to investigate the effect of migration on their family members. The main idea of IV is to find one or more valid instruments that only affect the outcome of interest through their effects on migration. This procedure can be achieved by many econometrical models, i.e., two-stage least squares (2SLS), IV probit, and bivariate probit, using software packages. However, the major stumbling block is that the instrument variables are arguably exogenous and very much likely to be weakly correlated with the outcome of interest, and the worse is, it is ultimately untestable.

Thus, it is not hard to find that researchers have converged on a small set of the least controversial and widely acknowledged instruments. The most popular instrument variable appears to be the historical migration rate (Hanson and Woodruff, 2003; Hildebrandt and McKenzie, 2005; McKenzie and Rapoport, 2011) and variables relating to economic conditions at destination locations (Amuedo-Dorante et al., 2008; Amuedo-Dorantes and Pozo, 2010; Antman, 2011; Cortes, 2004; Yang, 2008). The choice of these instruments is based on the “push-pull theory” (Ravenstein, 1976). The common “push” factors that compel people to leave their places of origin include poor living standards, low economic opportunities, and exhaustion of natural resources and calamities. The “pull” factors that attract people at the destination of migration include the demand for labour, the opportunity for higher living standards, and freedom and openness to the floating population.

Other issues that appeared in social science studies are also existing here. One is data availability. The quantitative empirical research on migrants and children mostly relies on the micro-data, which are collected initially from standard household surveys. However, such surveys have not explicitly aimed to collect the migration-related information, nor designed to analyse the economic implication on household members (Sasin and McKenzie, 2007). The other one is the definition of the "household" and "migrant" has not been unified in all documents, for instance, the "migrant[1]" is not admitted as a member of any "household[2]" in his/her original place of residence. Thus, we must carefully consider and choose the survey that provides full information; and if any additional information needs to be merged from other survey or national statistics, we must confirm the consistency of the definition and minimise the errors caused by different data sources.

1.5 Thesis Overview

The literature on migration is vast, and yet the impact of migration on the migrant's children is not well understood. The problem is partly due to the data problems that are typically significant for developing countries, but it is also because of the complexity of the problem itself. The impact can be different depending on whether we are studying the child when he/she

1 The definition of "migrant" in the Recommendations on Statistics of International Migration (United Nations, revision 1, 1998).
2 The definition of "household" in the United Nations System of National Accounts (1993 revision).

is accompanying the parents, i.e. at the source location, or when he/she is left behind at the native household. The impact can also vary with the outcome chosen, such as education, health, or mental wellbeing. Above all the impact may change over time, as the child gets used to the separation from the parent, and/or when the household begins to receive sizable remittances. Intuitively, migration should benefit the entire household and that should be reflected on the child's health or education as well. However, the benefits may take time to overcome the initial costs, both financial and emotional, and thus the short run impact can be negative. Such a possibility is further enforced when institutions or labour market regulations work to the detriment of the migrant.

In this thesis, I intend to study this problem for China, where the scanty literature on the children of the migrants reports mixed results. While that itself makes a case for continued investigation of the problem, it needs to be pointed out that most of the Chinese studies that I am aware of suffering from both data and modelling problems. Typically, the datasets are small and modelling do not try to control for any potential endogeneity issues. For these reasons, it is unclear to what extent their findings can be relied upon. Reliability of the findings is critical for any country, but more so for China, because China's sustained economic growth has been fuelled by sustained migration.

Using both city level data and national level household survey data of China I study the impact of parental migration on the child's education, physical health, and mental wellbeing. I also attempt to study the child at both destination and source location. My research objective can

be framed in terms of the following three questions.

i) When the children accompany their parents in migration, how do they perform at school compared to the local children? [Chapter 2 investigates this problem using city level data.]

ii) When the children do not accompany their migrant parent(s) and are left behind at the native household, how do they perform at school as compared to the children whose parents are not migrants? [Chapter 3 investigates this issue using national data for one year.]

iii) When the children do not accompany their migrant parent(s) and are left behind at the native household, how are their physical and mental health compared to the children whose parents are not migrants? [Chapter 4 investigates this question using national data for two years.]

The main econometric problem here is how to handle potential endogeneity of migration and biases caused by omitted variable (Huffman and Lange, 1989). Migration is generally not a random but a self-selective decision, in which case migration is likely to be correlated with individual characteristics. But it is acknowledged that migration is also likely to be correlated with some external factors. The empirical strategy in this thesis is to use instrumental variables and 2SLS estimations. This thesis consists of five chapters, including three empirical studies to answer the above questions

Chapter 2, "Learning Disparity between Migrant and Local Children: Evidence from Two Cities in China", focuses on children's educational outcome when children migrate together with parents at the destination location. The data used in this chapter is a cross-sectional data of junior high school children's science test scores (Youth Science Learning Survey, 2009) from two cities in Guangdong province, China. Using the IV approach to deal with the potential endogeneity of migration decision and controlling for the school type effect, we find that being a "migrant household" child reduces one's test score. Further, we see that the adaptation costs of the migrants do not fall over time to make any positive impact on the child's performance. That is, amongst the migrants, early arrival does not help ease out some of the disadvantages, and the overall migrant disadvantage may be more long term than transitory. Our findings also raise the concerns regarding restricted educational access by official permit *hukou* for migrant children which shall be urgently reformed.

Chapter 3, "When Parents Are Away: Effects of Migration on Children's Education in China", also emphasises on children's educational performance but shifts the view to the source location. This chapter examines the migration effect differentiated by father's migration, mother's migration, and both parents' migration on left-behind children. We use China Labor-force Dynamics Survey (CLDS, 2012) data and 2SLS estimations to investigate the effects. Two instruments are the crude out-migration probability (CMP) at the source location and the unemployment rate at the destination location. We compare the migrant and non-migrant rural households in terms of two measures: (i) self-reported school performance level, and (ii) private tutorial participation. The results show that due to parental absence, children lack

parental care and supervision, and in addition, they may have to devote some of their study time to household works. Though migrant family may have irregular remittances and end up enhancing incomes in the long run, there are significant short-run costs borne out by the family members, including the children. Thus, our analysis suggests that migration, though intended to improve the households' income and welfare, does inflict short-run costs on the household and underweights the fact that parents are away, some of which are reflected on the child's education.

Chapter 4, "Parental Migration and Child Health: A Source Location Study in China", works on children's health outcomes at the source location from three dimensions – physical, mental, and general health. This chapter looks at the household survey data of 2010 and 2014 from China Family Panel Studies (CFPS) and using IV estimates to analyse the effects of parental migration. Two instruments are crude migration probability (CMP) and the number of public transport vehicles for every 10,000 people; both are provincial-level instruments at the source location. While the OLS estimates show no difference between migrant and non-migrant child, instrumental variable (IV) method reveals a different picture. The IV estimates show that compared to the non-migrant children, migrant children are more likely to be underweight and mentally depressed. Further investigation shows that father's and mother's migrations do not always have the same effect on the child. While father's migration may have an adverse mental health effect, mother's migration surprisingly may not have any effects. Although we cannot pin down the causes of this, we conjecture that it could be due to a difference in their time allocation between work, while away from home, and maintaining contacts with the child. We

also see that when both parents are away, the child feel mentally depressed, but not necessarily physically unwell. These effects of migration are not always visible in both time periods, or for both genders of the child or across all age groups. But the overwhelming picture is the one of negative physical and mental health effects on the children.

Based on the findings of my research, certain policy recommendations are made in Chapter 5. The decision of migration is severely restricted suggesting that the government must implement the household registration system reform and provide long-term solutions for better urbanization construction and rational allocation of labour resources. The effect of labour migration on children, for instance, a negative effect on children's education requires the education system reform to ease restrictions on school admissions, moreover, the labour market policies should integrate with the education system. Likewise, at the source location, the left-behind children's health has also been adversely affected indicating the local government should learn and adopt advanced approaches and system to guarantee children's welfare. Finally, and yet importantly, our research pays close attention to child development, which is vital to human capital accumulation and technology progress in a developing country.

Table 1.1 Labour migration models in economics

	Perspective	Theory	Feature
Structuralism models	Social sector	Lewis dual economic theory; Fei & Rains model; Jorgenson model; Push-pull theory;	Based on the social structure, emphasis on the economic structure and the impact of unbalanced economic development on migrants.
Neoclassical models	Individual	Todaro model; Harris model;	Based on the individual economic behaviour, emphasis on the impact of maximum individual benefits on migration decision.
	Household	Portfolio investment theory; Contractual arrangement theory;	
Behavioural models	Characteristics	Wolpert “place utility” theory;	Emphasis on the impact of individual characteristics (gender, age, education level, etc.) on migration.

Appendix 1.1 China *hukou* system

China *Hukou* system refers to a special household registration system. Based on the Constitution of the People's Republic of China, all Chinese citizens must register and declare a *hukou* account after the birth. *Hukou* registration includes two parts: register in a habitual residence place as a resident, usually divided into rural and urban *hukou* account; register a residence type, usually divided into agricultural *hukou* and non-agricultural *hukou* account.

The household registration status of a Chinese citizen is dependent on the father or mother's *hukou* status (before 1998, only depend on mother's *hukou* status); individuals cannot change the *hukou* status as long as meet the corresponding conditions and be obtain government approval. Changes in household registration include following three cases: changing the residence place; changing the residence type (normally changes from agricultural type to non-agricultural type); changing both residence place and type (normally changes from rural to urban areas and from agricultural to non-agricultural type).

Table A1.1.1 Different *hukou* types

Residence place	Agricultural *hukou*	Non-agricultural *hukou*
Urban area	Rural migrant workers; Farmhand; Supported family members by above people;	Urban workers; National cadres and professional and technical personnel; Supported family members by above people;
Rural area	Township enterprises workers; Farmer; Supported family members by above people;	National farm workers National cadres and professional and technical personnel; Supported family members by above people;

Table A1.1.2 The development of China *hukou* system (after the founding of New China)

Year	Policy document	Content and feature
1949	Common Program of the Chinese People's Political Consultative Conference;	National household registration system has been established from urban to rural areas, managed by the public security department and no limit to citizens' residence place or migration freedom;
1958	Household Registration Ordinance of the People's Republic of China;	*Hukou* system has been regulated in the legal form, which is a symbol of officially formed national urban and rural household registration system;
1975	Constitution of the People's Republic of China;	Abolished the citizens' residence and migration freedom, the country fundamentally does not guarantee citizens residence and migration right;
1977	The decision on the Ministry of Public Security on Migration Process;	Clearly indicated an important policy that strictly control the population in the city or town;
1985	Interim Provisions on the Ministry of Public Security of Urban Transient Population Management;	Established administrative measures on registration that implement "temporary residence permit" and "residence Permit" for the floating population;
1985	Identity Card Bill of the People's Republic of China	Established and implemented identity card system, which becomes an individually and legally based national identity proof;
1994	Interim Regulations on the Management of Cross-Provincial Employment of Rural Workers;	Strictly control identity cards and safeguard social security;
2000	Opinions of Promoting the Healthy Development of Small Towns;	The farmer that has legal permanent residence, stable job or source of income in the urban area, county, or town, could change to urban *hukou* based on his/her wish. Also face the same treatment as urban residents with respect to child education, join the army, employment, etc.
2014	Opinions of the State Council on Further Promoting the Reform of the Household Registration System;	Adjust the household registration policy, unify the urban and rural household registration system, and fully implement the residence permit system.

Appendix 1.2 China educational provision for migrants

China's nine-year compulsory education requires the local *hukou* school-age children to attend "the nearest school" for the local *hukou* citizens while the migrants need to provide relevant documents, i.e. identification card, temporary residence permit, employment permit, health certificate of the parent, population planning certificate, social insurance certificate, guardianship certificate or birth certificate and health certificate of the child, to enrol a public school, or to attend private schools.

Table A1.2.1 Relevant educational provision for the migrants

Year	Policy document	Content and feature
1992	Compulsory Education Law Implementation of the People's Republic of China;	First proposed the educational problem for children of floating population;
1998	Interim Measures on Schooling for Children among Floating Population;	Proposed that private or simple schools can be organized legally for the children of floating population;
2001	Decision on Education Reform and Development in Basic Education;	Children of floating population receive compulsory education based on local government's management, mainly enrolled to full-time public schools;
2003	Opinions on Further Improving Compulsory Education for Children of Migrant Workers;	Proposed that inflow governments should charge children of floating population the same fees as local students; outflow governments should not charge fee for in students' transfer process;
2006	Compulsory Education Law of the People's Republic of China (Revised);	First clearly defined the equal compulsory education opportunities for the children of floating population in a legal perspective;
2012	Twelfth Five-Year Plan for National Education Development;	Protect the basic public educational right of migrant workers' children, improve the inflow governments' public financial support mechanism for migrant workers' children;

Chapter 2

Learning Disparity between Migrant and Local Children: Evidence from Two Cities in China

Summary: We study children's science test scores from two cities in China, where the children vary in terms of being migrant or local, and the schools vary in terms of being public or private. The test was not part of a regular school exam, and the assignment of school and the children to the test was random, thus allowing us to stay clear of the test participation bias issue. Using the IV approach to deal with the potential endogeneity of migration decision and controlling for the school type effect, we find that being a "migrant household" child reduces one's test score. Further, we see that the adaptation costs of the migrants do not fall over time to make any positive impact on the child's performance. That is, amongst the migrants early arrival does not help ease out some of the disadvantages, and the overall migrant disadvantage may be more long term than transitory.

2.1 Introduction

Conflict over the share of public resources is all too common between immigrants and domestic citizens, as borne out by various events in Europe and the USA. Migration studies have documented interactions between the natives and the immigrants (Akay et al., 2014; Barrett et al., 2012; Constant et al., 2009; and Dustmann et al., 2005). A similar conflict can also arise between migrant and non-migrant citizens of the same country.

In China, the migration policy is gradually being relaxed since the mid-1990s. People can freely search for jobs and move, but accessing public resources such as housing and schools is still regulated by the household registration system or the so-called *hukou* system, and an array of other local regulations. The *hukou* system keeps the record of Chinese citizens' residence location (rural or urban) and working type (agricultural or non-agricultural). This also means *hukou* can create a differential entitlement to local public goods like schools, health care or government housing. Migrants clearly remain at a disadvantage in these respects, vis-à-vis the local populations. In this context, it is important to study the migrant children's learning outcome.

In this chapter, we study learning disparity between the migrating and the local children using children's scientific test performance from two cities in China. The existing literature on China's domestic migration shows mixed educational outcomes for migrant children. For instance, Chen et al. (2013) show that majority of migrant children find it difficult to like their

schools, due to the difficulty of adapting to a new environment and/or the difficulty of integrating with the local children. On the other hand, studies like Lai et al. (2014) point out that migrant children on average academically perform much better than their peers at their villages where they have migrated from. However, Lai et al. (2014) do not claim that the migrant children perform better than the non-migrant children at the place where they have migrated to. So, it appears that while the migrant children may perform better than their cohort at the originating villages, their performance probably still has some catching up to do with that of the children where their families are settled now. The present chapter provides some additional evidence on this issue.

We study the scientific test performance scores of school children in two cities cutting across the private and public school types and migrant and non-migrant households. Our aim is to study whether being the children of migrants makes a difference to the children's test score.

The data is from the Youth Science Learning Survey, designed and collected by the Centre for Social Survey (CSS) in 2009, and consists of information on children's and their families' characteristics, along with their score on a common test on science. The test was open to the junior high school age group (adolescent boys and girls) and participants were randomly selected. Our data contains 1,250 observations (students) from five private schools and five public schools. All schools are located in two cities – Shenzhen and Zhongshan – in Guangdong province.

Identification strategy: In trying to identify the causal effect of the migrant status on performance, we need to be concerned about two sources of endogeneity. i) School choice could be correlated to the child's and/or household's attributes, for which we may or may not have information. ii) Parents' migration decision could be influenced by the desire to provide better schooling to their children. Ideally, to address these concerns we need to use at least two IVs with adequate attention given to the fact that migration decision and school choice are sequentially made.

However, some introspection allows us to restrict our analysis to one IV, namely for migration only, and to allow school choice as exogenously given. In China, public schools are widely regarded as a preferred option for superior funding and better teacher training. But access to public schools is also determined by having a local *hukou*, the entitlement to which is determined administratively and historically. Thus, parents have very little choice over the public school their children can go to. Of course, they have a choice over which is to go to private school if there is more than one in the local area. Unfortunately, our data do not permit explaining the private school choice. Given this limitation and with the policy of *hukou* in place, we can take school admission is as an exogenous assignment, rather than parental choice (Liang and Chen, 2010). If a low-income parent does not have a local *hukou* (in our context a local urban *hukou*) and fails to gain admission to the local public school (for which we have the test data), then he/she will have no choice but go to the least costly private school (Goodburn 2009; Wang, 2008). Many articles, which we cited here, have taken this pragmatic approach to address this issue.

In support of the presumed exogeneity of school status (private or public), we run two separate regressions: one with the school status as dependent variable and *hukou* as the independent variable, which confirms that urban *hukou* (which predominantly captures the non-migrant children) is a strong determinant of public school admission (see Table A2.1.1 in Appendix 2.1). Our other model involves students' test score as a dependent variable and *hukou* as an explanatory variable (after dropping the school status variable). This model shows that *hukou* does not (directly) explain students' test score admission (see Table A2.1.2 in Appendix 2.1).

Therefore, we confine our attention to the second source of endogeneity – that is of migration. To correct for this problem, we use the provincial crude migration probability (CMP) of the migrant household's source province as an IV for migrant status. This is a good instrument for several reasons. Firstly, the crude migration probability cannot be influenced by a single household. Secondly, the crude migration probability cannot possibly affect children's test performance. Thirdly, use of such instruments is widespread in the literature; see the seminal work of Munshi (2003) for Mexican migration. Implicitly, we are emphasizing here as the "migration push" factors as the key driver of migration. Our Figure 2.1 indeed shows that the sources of migration are concentrated in few not-so-far-away provinces. There could be additional "pull" factors, such as community linkage at destination could also be at play, like the network effect (Munshi, 2003).

Thus, the mechanism we believe is at work here is that households are largely driven by "push"

factors to migrate to a destination where they are able to secure a decent standard of living for the whole family, and then based on their *hukou* status and other administrative documents they get assigned to a school, where the public school is the preferred option and a local (costlier) private school is a default option. Children's test score is then a combination of effects of school assignment, own ability, and parental migration status, because migration involves psychological cost and a reallocation of new peers. Our IV then singles out the migration effect.

Model: We run a 2SLS model where the dependent variable is children's educational performance – the number of correct answers in the test expressed as a standard normal deviate with zero mean unit standard deviation, so called the child's standardised test score. The key independent variable is children's migration status. Other control variables include three sets – children's information, parental educational level, and household economic condition.

Results: The results show that being a migrant reduces the child's test score relative to a local child. The order of difference ranges from 0.842 to 1.048. This difference translates into 4.8 to 6.2 lower scores on average for a migrant child. The difference stands out, despite a control for the school type. Public schools contribute positively to the test scores for all children – migrant and non-migrant.

So the question is: Why are the migrant children disadvantaged? Conceptually, a migrant may face two types of costs in a new location: one is the private adaptation or setup costs that can

be optimised over time, and the other is access to government dwellings, nice neighbourhoods and wider public resources. Various studies in China point to the restricted access to facilities provided by the local government. So the second type of costs are much harder to optimise and it may persist over time. These costs do have an impact on a child's performance.

As we do not have data on either of these two costs, except school type, which we have controlled for, one factor we look at the length of residency at the current location to get a sense of how important these factors amongst the migrants. If we think that among these two types of costs, if the private costs are dominant, then over time they would ease out and child's test performance should improve with longer residency.

Focusing only on the subsample of migrants, we use the length of residency (in the destination city) as a determinant of test score. Our OLS result shows that indeed residency has a strong and positive effect. It does add roughly 1.5% to the average score, although the grade and public-school type contribute much more.

But one can raise an objection on the ground that the length of residency is linked to the migration decision and could suffer from endogeneity potentially. Although econometrically the residency variable passes the exogeneity test, one can make an argument on economic grounds. Therefore, we run two 2SLS models with two IVs – number of schools in the source location and the distance between the source location and the present city. Upon instrumenting the residency variable loses its significance. This suggests that staying longer in the present

location does not reduce the adaptation costs enough to make any causal impact on the test performance. This could be due to the greater importance of government controlled public resources that do not ease up easily.

The overall conclusion is then discouraging. The learning disparity attributable to the migrant status is widely shared by the early migrants and late migrants. There seem to be certain structural bottlenecks for the migrants that do not go away over time. This finding is similar to intergenerational poverty and backwardness found by many studies among the immigrant children of developed countries.

Contribution: Our contribution is to be seen in the context of the migration and education literatures of China. Many studies on China have separately studied the effects of migration on child's school attendance or language and maths test scores either at source or at destination. Most studies find negative effects of migration. Other studies do consider private versus public school effects, but not with the mix of migrant and non-migrant children. Their tests are also school-specific, not comparable across schools. These studies do find positive public school effects. There is also a third body of work in which the gender effect is studied; the result here is mixed. Ours is the first one that combines all three strands in one model, along with the advantage that our tests are same across schools and they are on the science subjects. While we do confirm the negative effect of migration and positive effect of public school and thus extend the body of evidence, the gender effect we see is favouring the boys. Ours is also an attempt to identify the causal effect of the migrant status. But we do accept the limitation that

our data set is smaller, and we do not have as much information as needed.

The structure of this chapter is organized as follows. Section 2 reviews the literature and proposes hypotheses. Section 3 presents the data, the study area, and descriptive statistics. Section 4 specifies the empirical model. Section 5 presents and discusses the estimation results. Section 6 concludes.

2.2 Conceptual Framework and Hypotheses

When children migrate together with parents at the destination location, their educational outcomes are affected by various scenarios. If the migrating family suffers from an oscillating type of job, the learning environment of their child is volatile, such as the teaching materials used in different regions are different as well as the schedule and requirements for different teachers are inconsistent. Thus, the migrant children often face to a breakdown of the knowledge and show dismal performance in the school (Roy et al., 2015; US General Accounting Office, 1994; Wu, 2006; Zhang et al., 2012).

In terms of the literature from China, most researches reveal one administrative and financial barrier – China's *hukou* system – to the migrant children that restrict their access to public schools (Goodburn, 2009; De Brauw and Giles, 2016). Due to the difficulties that the migrant children enrol to the public school, most of them can only enrol to poor-quality, non-

governmental private schools; more precisely, migrant schools are only for migrant children. As a result, migrant children's educational performance has been adversely affected at the destination location and the evidence shows that more than 50% of the migrant children indicate that they do not like new schools and miss their former peers and schools in poor rural areas (Chen and Feng, 2013; Chen et al., 2013). In addition to the institutional barrier, migrant children's educational performance cannot be inseparable from their family's environment. Bourdieu's (1993) theory of "cultural reproduction" and Bernstein's (2003) "code theory" remind us that due to a low family social status and the shortage of economic and cultural capital, the migrant children have been weakened long before they entered the school. Therefore, the educational disadvantage to the migrant children has been further strengthened.

According to the above theories and findings, we hypothesized a negative relationship between migration and children's education:

H_1: Migrant children at the destination locations will show a significant disadvantage in their educational performance comparing to local children.

However, in some respects there may be counter-veiling effects. To start with, migration may motivate parents, at least those who have greater human capital, can choose places with better educational opportunities (Zhan, 2015). Second, access to good public schools can mitigate some of the disadvantages of being migrants (Roy et al., 2015; Srivastava and Sasikumar, 2003). Besides, if migrant children study together with local children at the destination location, the intergroup contacts promote positive attitudes and interests in learning and

accordingly contribute to the academic performance (Koch and Nielsen, 2015). Last but not least, while moving from a less-developed to a developed area can enhance people's aspirations (Toyota et al., 2007), significant challenges may arise regarding adapting to the new environment (Hones and Cha, 1999; Trueba et al., 1990; Yale Center in Child Development and Social Policy, 2003). Conceptually, this translates into adaptation costs, which may have two parts – private and public. Over time people should be able to optimise over the private component, but not necessarily with the public component, which is controlled by the local government. These are access to social housing, nice neighbourhoods and government transfers, all of which are likely to affect a child's educational performance.

One way to decipher the effect of such "adaptation costs" is to study the effect of the length of residency in the destination area. If the adaptation costs are largely driven by the private costs, such costs are likely to be higher for the late migrants compared to the migrants who had come much earlier. On the other hand, if the public component is stronger, then there will not be any significant difference between the later and early migrants. To get a clearer picture on this issue, the regression can be conducted only within the migrant community.

Hence, we propose the following hypotheses:

H_2: Amongst the migrant children, early migrants will have a higher test score than the late migrants, controlling for the school type effect.

In addition, children's social development is distinguished by gender during the transitional

period between childhood and adolescent (Erikson, 1950). When children reside in a new environment, their behaviour reflects the emotional adjustment and social adaptation, and both of which indirectly act on children's schooling performance (Carlson and Wang, 2007). One issue has been addressed in Chinese culture is that parents show typically different expectations between boys and girls and thus educate them correspondingly. For instance, boys are expected at a high standard of educational performance so that their awareness of achievement and responsibility to the family can be enhanced while girls are trained to look after the family and adept at housework (Garside and Klimes-Dougan, 2002). Thus, we expect a nondirectional hypothesis:

H_3: Migrating boys and girls will show different adaptations to the new environment so that leading to the diversity of educational performance.

2.3 Data Description

2.3.1 The data

The dataset used in this paper is from the Youth Science Learning Survey designed and conducted by the Centre for Social Survey (CSS) at Sun Yat-Sen University in 2009[3]. The survey focuses on junior high school students' science knowledge and contained a specially designed test in science with 28 questions and a questionnaire with six parts concerning the

3 The original survey and data can be found from the official website of Sun Yat-Sen University (http://css.sysu.edu.cn/Data/). Registration for data access; documentations freely downloadable.

students: scientific knowledge, family social origins, education and career expectations, scientific interest, superstition and religion, peer groups, and environmental knowledge and awareness (extract questions can be found in Appendix 2.2). Ten schools are randomly selected from two urban cities, Shenzhen (3 public schools and 2 private schools) and Zhongshan (2 public schools and 3 private schools), both are in Guangdong province (see Table 2.1 for detailed school name and distribution). The surveys are sampled and distributed to the classes of different grades in these schools and 1,406 samples are collected.

Based on *hukou* information and children's places of birth, we classify i) all rural *hukou* holders, and ii) those urban *hukou* holders who came from outside of Zhongshan (if he/she currently resides in Zhongshan) and Shenzhen (if he/she currently resides in Shenzhen) are migrant children. Therefore, our number of observations drops to 1,250 students, and of which 693 are migrant children and 557 are the local children.

2.3.2 The study area

The province of Guangdong is the financial and economic centre in southern China and a major contributor to the country's economic growth. As one of the results, Guangdong province created a huge amount of job opportunities that attracts and absorbs almost 30% of migrants in China. City of Zhongshan is a historical city with 3.17 million residents, of which 1.54 million are local *hukou* citizens and 1.63 million are floating population (51.45%), while Shenzhen is a new city (built in 1980) and a rapidly developing economy with even a greater

proportion of the floating population (70%) – 7.52 million as opposed to 3.11 million local *hukou* residents. Thus, Shenzhen is very aptly called "the City of Immigrants".

Among those ten schools in the sample, the oldest and youngest ones are both from the city Zhongshan. The oldest school is a 101-year-old public school, and the youngest ones are two 3-year-old private schools. The average age of public schools is 49.4 years and that of private schools is 10.6 years. The average age of the Zhongshan schools is 36 years, while that of the Shenzhen schools is 18.6 years.

One issue that closely relates to the choice of school type is the Chinese household registration system, *hukou*. It is a certification system that identifies a household's residence region – rural or urban, and occupation type – agricultural and non-agricultural. A child's *hukou* type is determined by his/her parents' *hukou* type. All Chinese citizens must be registered and have a *hukou* account. The *hukou* account is transferable such as to a different location and/or different type, but it involves complicated procedures to obtain the government approval (see Appendix 1.1 for detailed China *hukou* system and development).

China's nine-year compulsory education requires children to attend "the nearest school" in their residency districts, which automatically condition their admission to a local *hukou* account. To seek a public school admission without a local *hukou* account, migrants need to provide an array of documents (see Appendix 1.2 for detailed China educational provision for migrants). Even migrants have fully prepared documents, public schools are oversubscribed

by local demands, and migrants eventually turn to fee-charging private schools without any better choices (Jialing, 2004).

2.3.3 Descriptive statistics

Among all migrant children, the majority of them (259 children) belong to the families that have migrated internally in Guangdong province. Figure 2.1 shows the distribution of migrating families' places of origin and most of them are from nearby provinces; moreover, 66% of the migrant children have origins of rural areas (455 out of 693). There is also an association between public schools and local children, as 55.38% of the children in public schools are the local, while in private schools only 32.83% of the children are the local (Table 2.2). The difference between local children and migrant children's attendance in public school is strongly significant suggesting a 21.8% higher rate (see Table 2.4 for the t-test).

Regarding the scientific test score, local children generally did better than the migrant children did. Among the children who performed at the top tier – 25 to 28 right answers – 62.77% of them are the local. Near the bottom, among the children who answered correctly from 10 to 14 questions, an overwhelming proportion, 72.36%, were migrants. Interestingly, at the very bottom tier (less than 10 correct answers) the local children dominate the migrants (Table 2.3). As Figure 2.2 and Figure 2.3 show the distribution of scores (the number of correct answers) of the local children is skewed rightward and the distribution of the marks of the migrants is somewhat bimodal. The overall difference in two groups of children's correct answers is

strongly significant showing that local children correctly answer at least one more question than migrant children do (Table 2.4).

Then we show the educational and occupational distributions of children's parents (Table 2.5 and Table 2.6). Among all parents, more than 40% of them only had a low educational background, 30% of the parents had a medium level of education, and only 25% of parents received a higher level of education. The occupational types show that over 40% of parents are running the private business, less than 20% of parents work in the general sector, and almost 40% of parents are in the professional area. Then we cross-compare parents' educational background and occupational type. As expected, results significantly indicate that highly educated parents are more in professional jobs, while low educated parents are into predominantly in business activities. The differences in parents' education between the local's groups and migrant children's groups are also significant, and the magnitude of the difference increases with respect to levels of educational.

In terms of the household wealth, we find that over 90% of all households own essential facilities such as refrigerator and washing machine, 88.6% of ones have a computer at home or a separate room belonging to the child, and 79.5% of ones own a kind of transports – car or motorbike. Then we compare these three types of ownership between non-migrants and migrants' households and find the former is in general better-off. All differences in the ownership of essential facilities, transport, and property are significant between two groups and non-migrants' households have an average of 10.7% higher rate of ownership (Table 2.4).

2.4 Model Specification

Our purpose is to examine the parental migration effect on children's test score, thus we start with a simple OLS model,

$$Y_i = \alpha_0 + \beta M_i + \boldsymbol{\theta}\mathbf{X}_i + \boldsymbol{\gamma}\mathbf{P}_i + \boldsymbol{\delta}\mathbf{F}_i + u_i \quad (2.1)$$

where the dependent variable Y denotes for children's education performance, which is the number of correct answers in the test expressed as a standard normal deviate with zero mean unit standard deviation. The effect of parental migration is captured by the coefficient β on M which is an indicator equal to 1 if the one or both parents are migrants and 0 otherwise. The children's information, **X**, is a set of control variables including children's age, gender, grade, school type, and city. The parental educational level **P** includes two levels, mid and high, referring to whether parents have a senior high school and university or above educational level respectively. The household economic condition **F** includes whether the household has essential housing facilities such as refrigerator, air conditioner, and washing machine, and whether the child has his/her own room or laptop.

Recognising that a household's migration decision can be endogenous to its child's subsequent educational performance, as good education can be a motivation for migration, we adopt the instrument variable (IV) approach and use 2SLS estimation to fix the endogeneity problem. The first-stage regression is followed as,

$$M_i = a_0 + bz_i + \boldsymbol{c}\mathbf{W}_i + v_i \tag{2.2}$$

where z is the instrument variable, province level crude out-migration probability[4] (CMP) at migrants' places of origin. $\mathbf{W}$ is a set of children, parents, and households control variables in previous models.

The IV is picked by following the push-pull theory (Ravenstein, 1976) in migration studies and the most popular IV – historical migration rate – using in the existing literature (Hanson and Woodruff, 2003; Hildebrandt and McKenzie, 2005; McKenzie and Rapoport, 2011). Besides, econometric tests are used to check the validity of the IV. We use the significance of the coefficient b to check the relevance condition and a robust F-statistics to check whether we have weak instrument issue. We also use the robust Hausman test (Wooldridge, 1995) to confirm if the regressor is endogenous. Then we obtain the fitted value $\widehat{M}_i$ from the first-stage regression and run the second-stage regression to produce $\hat{\beta}_{2\mathrm{SLS}}$.

Further, we investigate the migrant children only. We wonder whether longer years of residency at destination places improve their test performance, controlling children's places of origin. We first use a simple OLS model,

4 Van Imhoff (1991) suggests that the intensity of migration from the census data should represent a probability rather than a rate, thus, the crude migration probability is the simplest measure of population migration intensity. The probability is then subdivided into crude in-migration probability and crude out-migration probability. Formulas are as follows,

$$\text{Crude in-migration probability: } \mathrm{CM_iP_A} = \frac{\mathrm{M_i}}{\mathrm{P_A}}$$

$$\text{Crude out-migration probability: } \mathrm{CM_0P_A} = \frac{\mathrm{M_o}}{\mathrm{P_A}}$$

where $\mathrm{M_i}$ is the immigrate population; $\mathrm{M_o}$ is emigrate population; $\mathrm{P_A}$ is the total population of province A.

$$Y_i = \alpha_0 + \beta R_i + \rho H_i + \boldsymbol{\theta}\mathbf{X}_i + \boldsymbol{\gamma}\mathbf{P}_i + \boldsymbol{\delta}\mathbf{F}_i + u_i \quad (2.3)$$

where R denotes the years of *residency* in the current city – destination of their migration. H denotes migrant children's *hukou* type (urban = 1, rural = 0) and therefore reveals whether they are original from urban or rural areas. However, given that the years of residency is a subsequent decision following the migration, it is also endogenous. We therefore adopt the IV approach again,

$$R_i = d_0 + \boldsymbol{e}\mathbf{Z}_i + \boldsymbol{f}\mathbf{W}_i + \epsilon_i \quad (2.4)$$

where we use two instruments ($\mathbf{Z}$) in this case to address the endogenous issue. One is the distance between the places of origin and destination, and the other one is number of local schools at their places of origin. Because we investigate migrating children only, so both IVs only closely correlate to their parents' aspiration of residency but not the children's current performance at source locations. Again, we use econometric tests to confirm the validity of IVs. The relevance condition is checked by the significance of the coefficients ($\boldsymbol{e}$) for two instruments as well as the robust F-statistics from the first-stage regression. The exogeneous of IVs are supported by overidentification test (Sargan and Basmann). Then we obtain the fitted value $\hat{R}_i$ from the first-stage regression and run the second-stage regression to produce $\hat{\beta}_{2\text{SLS}}$.

In addition, we estimate the effect on migrant children in sub-samples to differentiate between boys and girls' test performance. Given that no more endogenous selection issue exists in migration nor the subsequence decision of the length of migration is considered, we simply

use OLS estimations. We also use seemingly unrelated estimations (SUEST) to test the difference in coefficients between sub-samples using Wald tests of simple and composite linear hypotheses about the parameters. All other control variables remain the same. Full variable description is presented in Table 2.7.

2.5 Estimation Results and Discussion

2.5.1 Non-IV estimate

Table 2.8 Non-IV estimates (extract)

Standardised test score (OLS)	(1)	(2)	(3)
Migrants	0.008	0.014	0.006
	(0.054)	(0.053)	(0.053)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	1250	1240	1240

See Table 2.8.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

* p < 0.1, ** p < 0.05, *** p < 0.01

We first report the baseline OLS/non-IV determinants of test scores. Our dependent variable "test score" is simply the number of correct questions (out of 28) correctly answered by the children expressed as a standard normal deviate – deviation from the mean score and divided by the standard deviation. As can be seen from Table 2.8, a family's status as "migrants" has no significant effect on children's test score. Being male, a senior grade child, or a public school child contributes positively to the test score. However, the migrant status, as chosen by

the parents despite restrictions implied by *hukou*, may depend on other variables or characteristics, or even the child's ability. Therefore, we need to use the IV estimates.

2.5.2 IV estimates

Firstly, we check the relevance of our instrument, crude out-migration probability (CMP) at the source location. The result in Table 2.9 is strongly significant indicating that if the source location has a high CMP, people are likely to emigrate. Also, the robust F-statistics are greater than 10, suggesting that we do not have the weak instrument issue.

Table 2.9 IV relevance condition (extract)

Migrants (OLS)	(1)	(2)	(3)
CMP	0.163***	0.163***	0.166***
	(0.038)	(0.038)	(0.038)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	1098	1089	1089
Robust F	18.571	18.293	19.159

See Table 2.9.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* p < 0.1, ** p < 0.05, *** p < 0.01

We now report the results from IV estimates (Table 2.10). The variable "Migrants" is the instrumented variable, and we can see that the effect of this variable is significantly different from the OLS estimates. Due to the fact that we have the same number of endogenous regressor and instrument variable, we are unable to check the exclusion condition using overidentification test; however, the significance of the robust Hausman test indeed confirms

the endogenous of the "Migrants" variable. Thus, migration has a significantly negative effect on children's test score and with the control variables added in, the magnitude varies from 1.048 standardised score to 0.816 standardised score. The migrant children therefore suffer from adapting to the new place and the learning environment, especially the majority of them are from rural areas where the living environment is completely different, and accordingly verifying our first hypothesis (H_1).

Table 2.10 IV estimates (extract)

Standardised test score (2SLS)	(1)	(2)	(3)
Migrants	-1.048**	-0.842*	-0.816*
	(0.478)	(0.460)	(0.450)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	1098	1089	1089
Robust Hausman	0.012	0.045	0.053

See Table 2.10.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

* p < 0.1, ** p < 0.05, *** p < 0.01

We also find that different school types affect children's performance and find that public schools show consistently significant and positive effects on children's test score, and in particular, the effect rises with the inclusion of the parental education and family wealth. In general, access to a public school, or to have a better education facility and teaching quality in China, is primarily determined by the type of *hukou* the parents possess. Though it is possible to get into a public school without a local *hukou* account, it requires a big effort of preparing complicated documents and the faith and persistence into education. As a result, public schools

contribute 0.316 standardised score higher test score than private schools. We also see that two cities are not equal; Zhongshan has a stronger effect on the test score, probably reflecting its historical reputation. Besides, children's places of origin show a significant effect on their performance.

Regarding children, parents, and households control variables, we find that boys have a better performance with 0.275 higher standardised score than girls, which largely relates to the interests' difference by gender. Though children in a higher grade benefit from a deeper understanding of science that knowledge they have learned from physics, chemistry and biology courses and show 0.439 higher standardised score, we find an age-grade distortion showing the fact that older children have a lower standardised score and the magnitude even doubling at the age group 16 to 18. Since all children are observed at the junior high school level, and according to China's education system[5] the age for this specific level is between 12 to 15, thus those children over the age of 15 may have learning difficulties so that cannot graduate in time and progress to the next level.

Parental education has a strong effect and with the increase in the level of educational, the effect becomes stronger. Highly educated parents emphasise on children's development not only the schooling performance but also the overall quality so that these children show advantages from the scientific perspective. The proxy variable "Essentials" refers the lowest

5 China's nine-year compulsory education includes six years of primary education (primary school), starting at age 6 or 7, and three years of junior secondary education (junior high school) for ages 12 to 15. After junior high school, there are three years of senior high school, which then completes the secondary education (People's Republic of China Compulsory Education Law, 1986).

household wealth level and the result shows a negative effect on children's standardised score suggesting that a poor household has limited study resources and the child's time may be occupied by sharing the housework.

It remains an open question: Why are migrant children falling behind? What is the reason? Researchers abundantly point out the difficulties migrant parents face in getting admission into good public schools, which is determined by local *hukou*. Our study accounts for school type, and still finds that controlling for the school type does not eliminate the (unfavourable) difference between the migrant and local children. This leads us to believe that the source of the migrant disadvantage should be within other factors such as local government transfers, social housing, nice neighbourhood etc. all of which can be broadly called the adaptation costs that a migrant must incur and the locals do not. The learning disparity is most likely to be a result of such environmental disparity that strongly correlates with the migrants. Unfortunately we do not have data to confirm this conjecture, but we do explore this issue with the subsample of migrants, which we discuss shortly.

2.5.3 Sub-sample estimates on migrant children

There is no denying that being a migrant means some additional costs are to be incurred that a local do not, such as finding a suitable area to live that should be not only safe but proximate to good schools, children's park and other facilities. Some of these facilities may be directly controlled by the local government and the migrants will have restricted access to. Other inputs

may be provided by the market (such as private tuition and hobby classes), but would be costly. Broadly, these costs can called adaptation costs, of which there is a private component and there is a public component. Over time, an individual can optimise on the private component, but not on the public component. If these costs come down over time, the family would benefit and we can expect those migrant children whose families come earlier would perform better than those children whose families have come later. In other words, test score should improve with the length of residency amongst the migrants. If not, then we can say that the adaptation costs are largely controlled by the government and they do not ease out over time, at least over a child's schooling years. This would be a disappointing news for the prospective migrant parents. Migrant disadvantage is not a transitory phenomenon.

Table 2.11 Non-IV estimates: sub-sample for migrants only (extract)

Standardised test score (OLS)	(1)	(2)	(3)
Hukou	0.081	0.037	0.057
	(0.061)	(0.060)	(0.061)
Residency	0.018**	0.012*	0.015**
	(0.007)	(0.007)	(0.007)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	693	691	691

See Table 2.11.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

* p < 0.1, ** p < 0.05, *** p < 0.01

With this objective we then investigate only the migrant subsample and consider two more factors, years of residency in the current city and places of origin – rural or urban – using their *hukou* type (Table 2.11). The result shows that there is no significant effect from the *hukou*

type indicating that it does not matter if the child migrates from urban or rural areas and at least the fundamental knowledge of science has been equally covered at both areas. Also, migrant children's places of origin are no longer significant effect once again confirming this point of view. Where they come from does not matter.

Now let us turn our attention to the interesting factor – years of residency. We first see a clear upward trend in Figure 2.4, and our OLS estimates also show that residency produces 0.015 to 0.018 higher standardised score (Table 2.11), supporting our second hypothesis (H_2). That means some of the disadvantages of being migrants gets mitigated over time, possibly through optimisaiton of the private component of the adaptation costs.

But this conclusion may not be very reliable, because one can argue at least economically that the length of residency may be correlated with the migration decision itself. For example, if parents are aware of this large adaptation costs, they might migrate well before deciding to have a child. In our model, although the variable "residency" passes the econometric test of exogeneity, it cannot escape the economic doubt. To address this concern, we run two instruments (Table 2.12) and find that on both occasion the IV estimates remove the significance of "residency" (Table 2.13). That means, the migrants are not able to reduce the adaptation costs sufficiently to experience an impact on their child's educational performance. In other words, the disadvantage of the migrants are not transitory; they persist over time.

Table 2.12 IV relevance condition: sub-sample for migrants only (extract)

Residency	(1)	(2)	(3)
Distance	-0.014***	-0.013***	-0.011***
	(0.002)	(0.002)	(0.002)
No. of schools	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	509	507	507
Robust F	21.939	20.717	17.555

See Table 2.12.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 2.13 IV estimates: sub-sample for migrants only (extract)

Standardised test score (2SLS)	(1)	(2)	(3)
Hukou	-0.002	-0.078	-0.053
	(0.073)	(0.073)	(0.077)
Residency	0.021	0.012	0.023
	(0.030)	(0.030)	(0.033)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	509	507	507
Robust Hausman	0.818	0.942	0.697
Sargan and Basmann	0.056	0.117	0.116

See Table 2.13.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* p < 0.1, ** p < 0.05, *** p < 0.01

Among other variables, we notice that public schools show a strongly positive effect, therefore we divide migrant children into two groups, studying in private schools or public schools, to examine their scientific test score. In Table 2.13, we find a significant difference, going by the OLS estimates, in the effect of years of residency between migrant children studying in public or private schools. In addition, the age-grade distortion is evident to the migrant children in

private schools so that we must accept the fact that learning difficulties have not been solved to old migrant children and this has also been found in urban high schools from New York city (Stiefel et al., 2010).

At last, we discuss children's gender in the scientific test since it has shown strongly significant effects in all estimations (Table 2.14). Initially, boys or migrant boys show advantages in the scientific test and achieve roughly 0.3 higher standardised score than girls or migrant girls, but we are curious whether the determinants of migrant boys' and girls' performance are different, thus, we divide migrant children by gender into another two groups. In order to eliminate potential subsequence endogenous factor, years of residency, we only include *hukou* type as the additional information for migrants.

Table 2.14 Non-IV estimates: sub-sample for migrants in different gender (extract)

Standardised test score (OLS)	Girls	Boys	Diff. (girls-boys)
Hukou	0.103	0.042	0.061
	(0.103)	(0.091)	
Children's controls	YES	YES	YES
Parents' controls	YES	YES	YES
Households' controls	YES	YES	YES
Observations	347	344	

See Table 2.14.1 for full regression results.
The heteroscedasticity-robust standard error is reported in the brackets.
"YES" means the model includes that set of control variables.
* p < 0.1, ** p < 0.05, *** p < 0.01

The results show that both boys and girls benefit from being in a higher grade, attending the public school, and born in a well-educated family. However, only migrant girls benefit from residing in Zhongshan city whereas only migrant boys are negatively affected by their age and household wealth. Comparing the magnitudes, girls are more susceptible to the environment

and having difficulties to integrate than boys, and this can be explained by the patriarchal traditions and differentiated ways of parenting in China. However, none of the determinants show significant differences between migrant boys and girls so our last hypothesis (H_3) is only partially proved that we do see the difference but insignificant.

2.6 Conclusion

International migration statistics identify approximately 740 million people, or roughly over 10% of the global population, as the domestic migrant. Since the 1990s, China's labour migration from rural to urban areas has surged and remains at a very high rate until now, becoming one of the highest in the developing world. Meanwhile, with the rapid economic growth in China, the urbanization rate has reached 50%; villages are being transformed and possibly the public facilities are improving across the board. More rural residents decide to migrant to rural areas, seeking more job opportunities and better living environment. However, migration is not always a personal choice, but relating to the whole family. The children who migrate together may feel difficulties in adapting to the new environment; their educational performance can be affected if they enrol to different types of school. Therefore, this chapter studies the learning disparity between migrant and local children at the destination location.

We have used a specific dataset, Youth Science Learning Survey, from the Guangdong province in China that reflects children's learning achievement. Performance in this common

test allows us to study whether there is a difference in the schooling performance between a migrant child and a local child. Our OLS estimate reveals no difference, but this is misleading potentially due to the migration decision being endogenous. Once we instrument the migration decision, the IV estimates reveal significant disadvantage that migrant children suffered at the new place and have restricted access to quality education – public schools, but once they enrolled, their performance is significantly better than ones in private school. Further in our sub-sample estimates, we examine the migrant children only and find that when the years of residency is regarded as the subsequence of migration and controlled for its potential endogeneity. However, we fail to see any significant evidence of improvements by residing a long period and also it reveals that long residency cannot reduce enough adaptation costs to make any causal impact on the child's test performance.

Our findings share the concerns expressed by many other studies regarding the educational access of the migrants. The plight is similar to many international migrants in countries that have a significant amount of immigration. This raises the question about the Chinese government's administration of the *hukou* system and management of large-scale migration. Policies should be changed to ensure better access to education for migrant children. Due to the data limitation, we could only use the cross-sectional data that does not allow us to capture some unobserved factors such as economic shock to the family, therefore we shall give a more accurate explanation if a longitudinal data becomes available. Also, we could have proven the exogeneity of our IV using overidentification restriction if we have more than one instrument.

Figure 2.1 Migration distance and the number of migrants

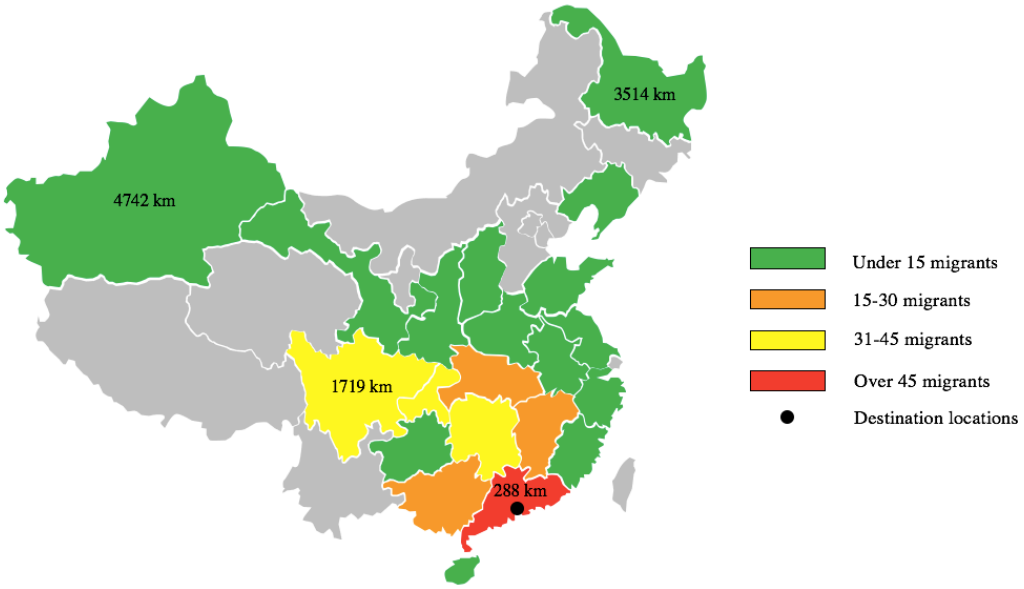

Figure 2.2 Number of right answers for migrants

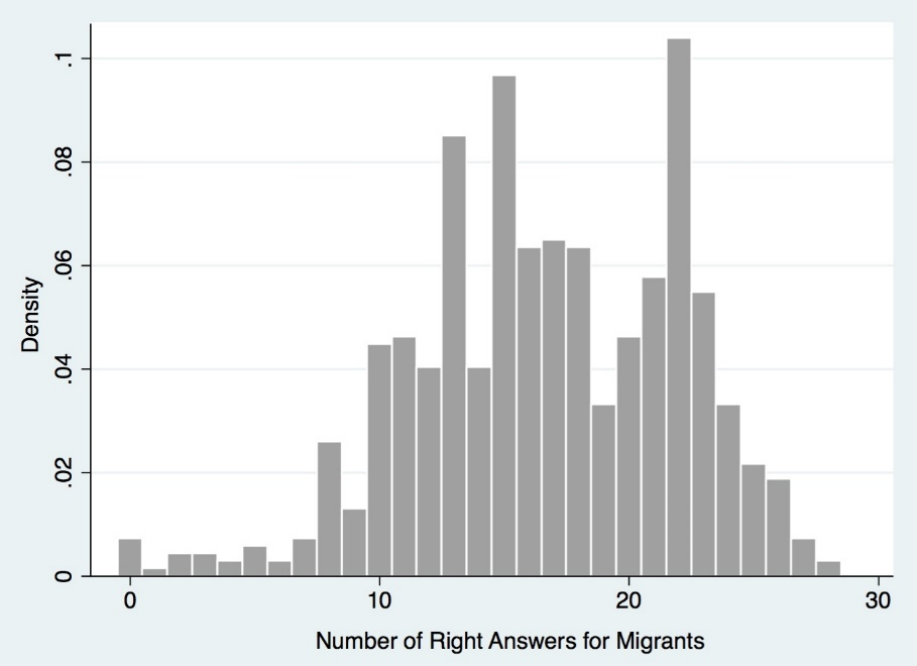

Figure 2.3 Number of right answers for non-migrants

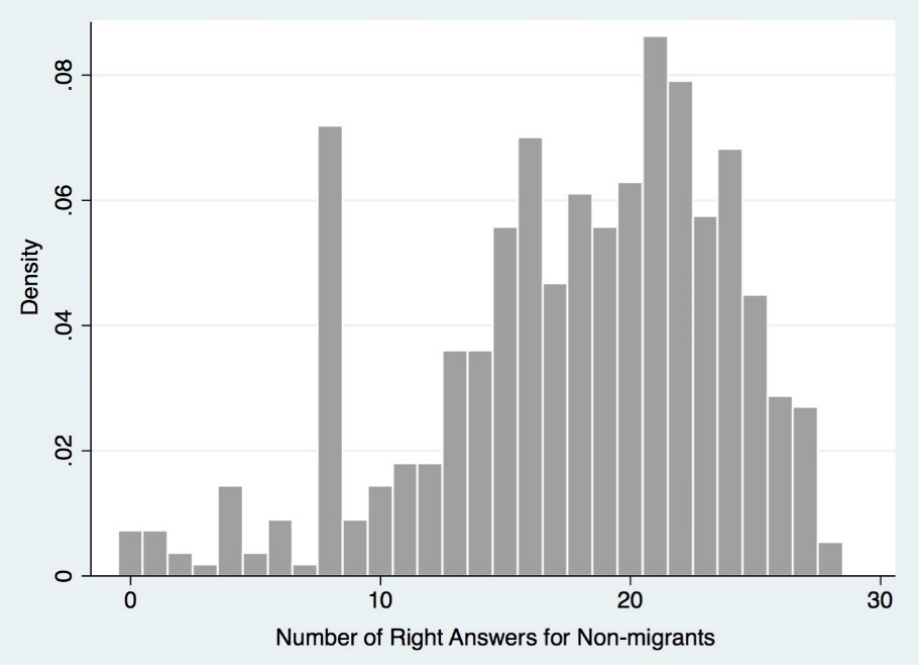

Figure 2.4 Migrants' standardised test score and years of residency

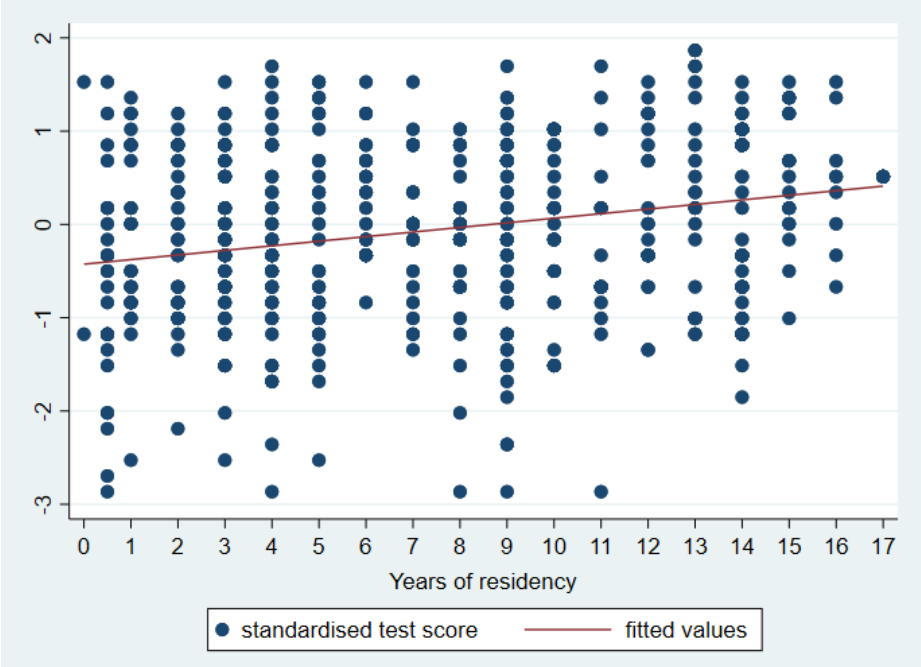

Table 2.1 City-wise distribution of schools

	Shenzhen	Zhongshan
Public schools	School 7 (Shenzhen Shajing School) School 8 (Shenzhen Xinzhou School) School 10 (Shenzhen Shixi School)	School 4 (Zhongshan No.1 Middle School) School 6 (Zhongshan Houtou School)
Private schools	School 1 (Shenzhen Hongji School) School 9 (Shenzhen Jinyuan School)	School 2 (Zhongshan Sanxin School) School 3 (Zhongshan Tuanyi School) School 5 (Zhongshan Xinchangjiang School)

Table 2.2 Shares of migrant and local children in different school types

	Migrant children	Local Children
Public schools	290 44.62%	360 55.38%
Private schools	403 67.17%	197 32.83%

Table 2.3 Shares of migrant children and local children in each category of correct answer

	Number of correct answers				
	25-28	20-24	15-19	10-14	Below 10
Migrant children	35 37.23%	205 51.00%	223 58.07%	178 72.36%	52 41.94%
Local Children	59 62.77%	197 49.00%	161 41.93%	68 27.64%	72 58.06%

Table 2.4 Difference in mean between non-migrants and migrants (t-test)

	Non-migrants		Migrants		
Variable	obs(0)	mean(0)	obs(1)	mean(1)	mean-diff
Correct Answers	549	17.831	691	16.722	1.108***
Hukou	549	0.561	691	0.343	0.218***
Grade	549	2.062	691	1.944	0.118**
Age 1	549	0.131	691	0.140	-0.009
Age 2	549	0.572	691	0.627	-0.055*
Age 3	549	0.297	691	0.233	0.064**
Gender	549	0.434	691	0.498	-0.064**
School type	549	0.650	691	0.418	0.232***
City	549	0.506	691	0.410	0.097***
Parents' education					
Low	549	0.297	691	0.441	-0.144***
Medium	549	0.281	691	0.226	0.055**
High	549	0.251	691	0.191	0.060**
Household wealth					
Transport	549	0.863	691	0.740	0.124***
Essentials	549	0.985	691	0.861	0.124***
Property	549	0.927	691	0.854	0.073***

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.5 Parents' educational background and occupational type

	Overall	Low Edu	Medium Edu	High Edu
Overall	-	44.66%	29.58%	25.76%
Business	42.59%	47.66%	31.4%	20.94%
General Work	18.89%	56.71%	32.93%	10.37%
Professionals	38.52%	28.29%	29.61%	42.11%

Table 2.6 Correlation between parents' educational background and occupation

	Low Edu	Medium Edu	High Edu	Business	General Work	Professionals
Low Edu	1					
Medium Edu	-0.451***	1				
High Edu	-0.413***	-0.305***	1			
Business	0.070**	0.051*	-0.052*	1		
General Work	0.118***	0.048*	-0.124***	-0.290***	1	
Professionals	-0.195***	-0.008	0.204***	-0.457***	-0.250***	1

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.7 Descriptive Statistics

Variable	Description	Obs	Mean	SD	Min	Median	Max
Correct Answers	Number of correct answers out of 28 scientific questions	1250	17.169	5.668	0	18	28
Standardised Test Score	The number of correct answers in the test expressed as a standard normal deviate with zero mean unit standard deviation.	1250	0.035	0.957	-2.864	0.175	1.864
Migration	Dummy variable, migrants=1, non-migrants=0.	1250	0.554	0.497	0	1	1
CMP	Crude out-migration probability at provincial level.	1098	0.741	0.409	0.02	0.815	1.54
Residency	Years of residency at the current city for migrants.	693	7.751	4.606	0	8	17
Distance	Distance (km) between the source location and the present city for migrants.	567	584.6	564.3	40	346	4742
No.of schools	Number of schools in the source location for migrants.	509	982	630.2	47	821	2498
Hukou	Dummy variable, urban *hukou* type=1, rural *hukou* type=0.	1250	0.439	0.496	0	0	1
Grade	The grade of students, grade 1, 2, and 3 in the junior high school.	1250	1.998	0.823	1	2	3
Age 1	Children's age group 1, age between 9 to 13	1250	0.137	0.344	0	0	1
Age 2	Children's age group 2, age between 14 to 15	1250	0.602	0.490	0	1	1
Age 3	Children's age group 1, age between 16 to 18	1250	0.262	0.440	0	0	1
Gender	Dummy variable, boys=1, girls=0.	1250	0.468	0.499	0	0	1
School type	Dummy variable, public school=1, private school=0.	1250	0.520	0.500	0	1	1
City	Dummy variable, Zhongshan=1, Shenzhen=0.	1250	0.455	0.498	0	0	1
Low	Parental education dummy variable, low = 1, if parents have junior high school level; low = 0, if not.	1240	0.377	0.485	0	0	1
Medium	Parental education dummy variable, medium = 1, if parents have senior high school level; medium = 0, if not.	1240	0.250	0.433	0	0	1
High	Parental education dummy variable, high = 1, if parents have higher educational level; high = 0, if not.	1240	0.218	0.413	0	0	1
Transport	Household wealth dummy variable, transport = 1, if the family has either car or motorbike; transport = 0, if not.	1250	0.795	0.404	0	1	1
Essentials	Household wealth dummy variable, essentials = 1, if the family has either refrigerator or air conditioner or washing machine; essentials = 0, if not.	1250	0.917	0.276	0	1	1
Property	Household wealth dummy variable, property = 1, if the family has either computer or child's own room; property = 0, if not.	1250	0.886	0.317	0	1	1

Table 2.8.1 Non-IV estimation (OLS)

Standardised test score (OLS)	(1)	(2)	(3)
Migrants	0.008	0.014	0.006
	(0.054)	(0.053)	(0.053)
Gender	0.264***	0.248***	0.241***
	(0.050)	(0.049)	(0.049)
Grade	0.471***	0.431***	0.437***
	(0.037)	(0.037)	(0.037)
Age group			
14-15	-0.233***	-0.197***	-0.201***
	(0.069)	(0.069)	(0.069)
16-18	-0.592***	-0.492***	-0.498***
	(0.104)	(0.102)	(0.101)
School type	0.569***	0.492***	0.522***
	(0.056)	(0.061)	(0.064)
City	0.438***	0.397***	0.398***
	(0.055)	(0.057)	(0.057)
Parents' education			
Medium		0.214***	0.227***
		(0.060)	(0.061)
High		0.375***	0.390***
		(0.065)	(0.066)
Household wealth			
Essentials			-0.075
			(0.091)
Property			-0.113
			(0.079)
Constant	-1.233***	-1.266***	-1.120***
	(0.088)	(0.086)	(0.114)
Observations	1250	1240	1240
Prob>F	0.000	0.000	0.000
R-squared	0.202	0.232	0.233

The heteroscedasticity-robust standard error is reported in the brackets.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 2.9.1 IV relevance condition (first-stage, OLS)

Migrants (OLS)	(1)	(2)	(3)
CMP	0.163***	0.163***	0.166***
	(0.038)	(0.038)	(0.038)
Gender	0.066**	0.065**	0.048*
	(0.029)	(0.029)	(0.029)
Grade	-0.020	-0.016	-0.006
	(0.022)	(0.022)	(0.022)
Age group			
14-15	0.027	0.019	0.016
	(0.046)	(0.046)	(0.046)
16-18	-0.031	-0.040	-0.050
	(0.061)	(0.062)	(0.061)
School type	-0.290***	-0.288***	-0.256***
	(0.030)	(0.031)	(0.033)
City	-0.200***	-0.197***	-0.193***
	(0.029)	(0.030)	(0.030)
Parents' education			
Medium		-0.057	-0.039
		(0.035)	(0.036)
High		-0.005	0.017
		(0.039)	(0.040)
Household wealth			
Essentials			-0.285***
			(0.042)
Property			0.036
			(0.048)
Constant	0.666***	0.682***	0.874***
	(0.058)	(0.058)	(0.061)
Observations	1098	1089	1089
Robust F	18.571	18.293	19.159
R-squared	0.129	0.132	0.154

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10.1 IV estimation (2SLS)

Standardised test score (2SLS)	(1)	(2)	(3)
Migrants	-1.048**	-0.842*	-0.816*
	(0.478)	(0.460)	(0.450)
Gender	0.323***	0.299***	0.275***
	(0.065)	(0.061)	(0.058)
Grade	0.455***	0.424***	0.439***
	(0.048)	(0.045)	(0.044)
Age group			
14-15	-0.222***	-0.197**	-0.204***
	(0.086)	(0.078)	(0.077)
16-18	-0.640***	-0.535***	-0.547***
	(0.130)	(0.121)	(0.119)
School type	0.280*	0.249	0.316**
	(0.164)	(0.157)	(0.143)
City	0.262***	0.249***	0.260***
	(0.100)	(0.095)	(0.091)
Parents' education			
Medium		0.223***	0.257***
		(0.072)	(0.069)
High		0.377***	0.414***
		(0.080)	(0.079)
Household wealth			
Essentials			-0.316**
			(0.159)
Property			-0.083
			(0.089)
Constant	-0.405	-0.598	-0.317
	(0.381)	(0.376)	(0.452)
Observations	1098	1089	1089
Prob>chi2	0.000	0.000	0.000
R-squared	0.072	0.099	0.120
Robust Hausman	0.012	0.045	0.053

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.11.1 Non-IV estimation: sub-sample estimation for migrant children only (OLS)

Standardised test score (OLS)	(1)	(2)	(3)
Hukou	0.081	0.037	0.057
	(0.061)	(0.060)	(0.061)
Residency	0.018**	0.012*	0.015**
	(0.007)	(0.007)	(0.007)
Gender	0.253***	0.245***	0.223***
	(0.059)	(0.058)	(0.059)
Grade	0.555***	0.525***	0.528***
	(0.044)	(0.046)	(0.045)
Age group			
14-15	-0.372***	-0.311***	-0.295***
	(0.084)	(0.082)	(0.084)
16-18	-0.584***	-0.470***	-0.454***
	(0.121)	(0.123)	(0.123)
School type	0.500***	0.456***	0.514***
	(0.076)	(0.075)	(0.079)
City	0.128*	0.106	0.111
	(0.077)	(0.076)	(0.076)
Parents' education			
Medium		0.070	0.101
		(0.072)	(0.073)
High		0.376***	0.401***
		(0.078)	(0.080)
Household wealth			
Essentials			-0.156
			(0.098)
Property			-0.157
			(0.103)
Constant	-1.307***	-1.309***	-1.113***
	(0.095)	(0.094)	(0.111)
Observations	693	691	691
Prob>F	0.000	0.000	0.000
R-squared	0.293	0.320	0.327

The heteroscedasticity-robust standard error is reported in the brackets.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 2.12.1 IV relevance condition: sub-sample estimation for migrant children only (first-stage, OLS)

Residency (OLS)	(1)	(2)	(3)
Distance	-0.014***	-0.013***	-0.011***
	(0.002)	(0.002)	(0.002)
No. of schools	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)
Hukou	0.971**	0.752*	0.573
	(0.417)	(0.435)	(0.450)
Gender	0.105	0.131	0.270
	(0.375)	(0.376)	(0.381)
Grade	1.065***	0.944***	0.928***
	(0.271)	(0.281)	(0.280)
Age group			
14-15	0.705	1.042*	1.120*
	(0.545)	(0.580)	(0.571)
16-18	-0.170	0.264	0.307
	(0.771)	(0.811)	(0.806)
School type	2.869***	2.773***	2.371***
	(0.484)	(0.504)	(0.529)
City	0.358	0.348	0.294
	(0.475)	(0.498)	(0.501)
Parents' education			
Medium		0.748	0.629
		(0.508)	(0.503)
High		0.933	0.792
		(0.575)	(0.577)
Household wealth			
Essentials			1.905***
			(0.542)
Property			0.099
			(0.556)
Constant	3.125***	2.809***	1.315*
	(0.693)	(0.722)	(0.833)
Observations	509	507	507
Robust F	21.939	20.717	17.555
R-squared	0.214	0.222	0.241

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 2.13.1 IV estimation: sub-sample estimation for migrant children only (2SLS)

Standardised test score (2SLS)	(1)	(2)	(3)
Residency	0.021	0.012	0.023
	(0.030)	(0.030)	(0.033)
Hukou	-0.002	-0.078	-0.053
	(0.073)	(0.073)	(0.077)
Gender	0.186***	0.203***	0.197***
	(0.066)	(0.066)	(0.066)
Grade	0.569***	0.553***	0.545***
	(0.058)	(0.056)	(0.057)
Age group			
14-15	-0.414***	-0.302**	-0.319***
	(0.115)	(0.119)	(0.122)
16-18	-0.608***	-0.470***	-0.478***
	(0.151)	(0.152)	(0.152)
School type	0.354***	0.332***	0.339***
	(0.129)	(0.116)	(0.113)
City	0.002	-0.043	-0.044
	(0.091)	(0.087)	(0.086)
Parents' education			
Medium		0.028	0.031
		(0.088)	(0.087)
High		0.431***	0.422***
		(0.114)	(0.114)
Household wealth			
Essentials			-0.031
			(0.124)
Property			-0.162
			(0.114)
Constant	-1.094***	-1.118***	-1.019***
	(0.158)	(0.148)	(0.150)
Observations	509	507	507
Prob>chi2	0.000	0.000	0.000
R-squared	0.298	0.334	0.335
Robust Hausman	0.818	0.942	0.697
Sargan and Basmann	0.056	0.117	0.116

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.14.1 Non-IV estimation: sub-sample estimation for migrant in different gender (OLS)

Standardised test score (OLS)	Girls	Boys	Diff. (girls-boys)
Hukou	0.103	0.042	0.061
	(0.103)	(0.091)	
Grade	0.496***	0.576***	-0.080
	(0.067)	(0.062)	
Age group			
14-15	-0.137	-0.381***	0.244
	(0.140)	(0.139)	
16-18	-0.278	-0.588***	0.310
	(0.192)	(0.175)	
School type	0.457***	0.688***	-0.231
	(0.103)	(0.100)	
City	0.252**	0.007	0.245
	(0.102)	(0.094)	
Parents' education			
Medium	0.147	0.156	-0.009
	(0.110)	(0.098)	
High	0.395***	0.392***	0.003
	(0.129)	(0.112)	
Household wealth			
Essentials	-0.053	-0.203*	0.150
	(0.154)	(0.120)	
Property	0.014	-0.245*	0.259
	(0.147)	(0.127)	
Constant	-1.387***	-0.705***	-0.682***
	(0.199)	(0.149)	
Observations	347	344	
Prob>F	0.000	0.000	
R-squared	0.289	0.359	

The heteroscedasticity-robust standard error is reported in the brackets.

* p < 0.1, ** p < 0.05, *** p < 0.01

Appendix 2.1 School choice and *hukou* type

Table A2.1.1 Non-IV estimation: school choice and *hukou* type

School type (OLS)	(1)
Hukou	0.107***
	(0.026)
Gender	0.024
	(0.025)
Grade	-0.059***
	(0.022)
Age group	
14-15	0.126***
	(0.041)
16-18	0.184***
	(0.058)
City	-0.317***
	(0.025)
Parents' education	
Medium	0.091***
	(0.032)
High	0.232***
	(0.032)
Household wealth	
Essentials	0.225***
	(0.038)
Property	0.341***
	(0.031)
Constant	0.019
	(0.051)
Observations	1240
Prob>F	0.000
R-squared	0.259

The heteroscedasticity-robust standard error is reported in the brackets.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table A2.1.2 IV estimation: school choice and *hukou* type

Standardised test score (2SLS)	(1)
Migrants	-1.123**
	(0.446)
Hukou	-0.014
	(0.106)
Gender	0.284***
	(0.062)
Grade	0.433***
	(0.050)
Age group	
14-15	-0.186**
	(0.086)
16-18	-0.539***
	(0.145)
City	0.157**
	(0.067)
Parents' education	
Medium	0.271***
	(0.076)
High	0.489***
	(0.082)
Household wealth	-0.350*
Essentials	(0.182)
	-0.001
	(0.092)
Constant	-0.008
	(0.471)
Observations	1089
Prob>chi2	0.000
R-squared	0.125

The heteroscedasticity-robust standard error is reported in the brackets.

* p < 0.1, ** p < 0.05, *** p < 0.01

Appendix 2.2 Extract scientific test

0. Dental caries

Human oral bacteria can cause dental caries (tooth decay). Since the 18th century, the expansion of the sugarcane industry led to the widespread of sucrose so that the caries problem arises. Nowadays, people are acknowledged that:

· The cause of tooth decay is sugar food based bacteria.

· Sugar turns into acid.

· Acid can damage the teeth surface.

· Brushing teeth can prevent from dental caries.

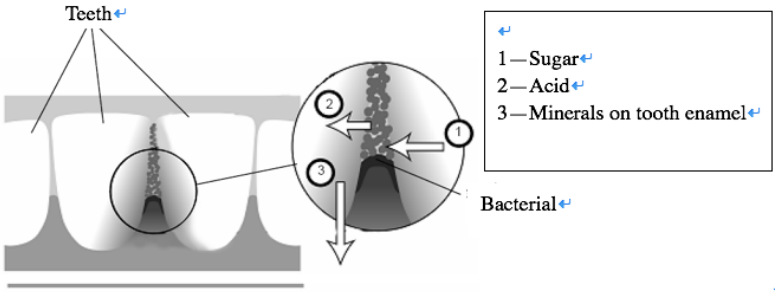

Figure A2.2.1 Dental caries

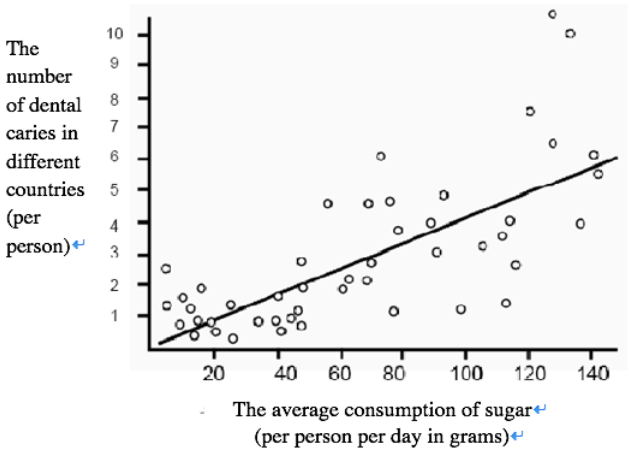

Figure A2.2.2 Sugar and dental caries

(0) What is the role of bacteria in the process of generating dental caries in Figure 1: _____

1 Bacteria generate enamel　　2 Bacteria generate sugar

3 Bacteria generate minerals　　4 Bacteria generate acid

(2) The Figure 2 shows the consumption of sugar and the amount of dental caries in different countries, each dot represents a country.

Which one of the following options can be supported by the data in the figure above?

1 In some countries, people brush teeth more frequently than the other countries.

2 The more sugar that people eat, the more likely to have dental caries.

3 In recent years, the proportion of caries infection in many countries rises.

4 In recent years, the amount of sugar consumption in many countries rises.

(3) If many people in a country have dental caries, which of the following questions can be answered by scientific experiments? Tick '1' denotes 'Yes', '2' denotes 'No'.

Can these questions answer by scientific experiments?

What will happen to dental caries when add fluoride into water?	1 □	2 □
How much need to spend to see the dentist?	1 □	2 □

2. Evolution

(2) What depth research can scientists do to identify the evolution of horse has evolved over time? Tick '1' denotes 'Yes', '2' denotes 'No'.

Can these researches identify the evolution of horse?

Compare the number of horses in different periods.	1 □	2 □
Look for bones of horse's ancestors living between fifty million years and forty million years ago.	1 □	2 □

(3) Which one of the following statement is the best match of the evolution theory?

1 The evolution theory cannot be trusted because it is unable to see the changes of species.

2 The evolution theory is possible for animals, but cannot be applied to human beings.

3 The evolution theory is based on substantial scientific evidence.

4 The evolution theory has been scientifically proved to be correct.

3. According to your understanding, identify the following views. Tick '1' denotes 'True', '2' denotes 'False' and '3' denotes 'Don't know'.

	1	2	3
1 The temperature of earth core is very high.	□	□	□
2 The Earth travels around the Sun.	□	□	□
3 The oxygen we breathe comes from plants.	□	□	□
4 Mother's gene determines the gender of the child.	□	□	□
5 Laser is generated by the convergence of sound.	□	□	□
6 Electron is smaller than atom.	□	□	□
7 Antibiotics can kill the virus.	□	□	□
8 The Universe is generated from the Big Bang.	□	□	□
9 The mainland that our lives on have been slowly drifting for millions years and will continue drifting.	□	□	□
10 As known so far, humans are evolved from the earlier animals.	□	□	□
11 Smoking can cause lung cancer.	□	□	□
12 The earliest humans lived in the same age with dinosaurs.	□	□	□

13 Milk that contains radioactive substances is harmless to humans after boiling	□	□	□
14 Light travels faster than sound.	□	□	□
15 All radioactive phenomena are caused by human.	□	□	□
16 The Earth takes a month to revolve around the Sun.	□	□	□

4. Please match the following three columns: pollution sources, pollution and corresponded environmental problems.

	Pollution sources	Pollution	Corresponded environmental problems
1	①Phosphorus contained wash powder	a. Deforestation	i. Death of fish
2	②Disposable chopsticks	b. Land salinization	ii. Acid rain and the greenhouse effect
3	③Plastic bags	c. Water Eutrophication	iii. Ultraviolet light pollution
4	④Automobile exhaust	d. Carbon dioxide sulphur dioxide emissions	iv. Land productivity decline
5	⑤Refrigerant (Freon)	e. Ozone hole	v. Soil erosion

Answers

1. (1) 4; (2) 2; (3) 1 2;

2. (2) 2 1; (3) 3;

3. 11122 12111 122122

4. 1 ① — c — I; 2 ② — a — v; 3 ③ — b — iv; 4 ④ — d — ii; 5 ⑤ — e — iii;

Chapter 3

When Parents Are Away: Effects of Migration on Children's Education in China

Summary: In this chapter we study the effects of migration on educational achievement and efforts of children who are left behind at home. By considering CLDS 2012 household data we compare the migrant and non-migrant rural households in terms of two measures: (i) self-reported school performance level, and (ii) private tutorial participation. OLS estimates show no difference either in achievement or in efforts. But when we use instruments (provincial migration rate and unemployment rate) migration is seen to reduce both achievement and effort – the latter more strongly. Our analysis suggests that migration, though intended to improve the households' income and welfare, does inflict short-run costs on the household, some of which are reflected on the child's education.

3.1 Introduction

Parents are the first and life-long teachers to their children. They teach children languages, culture, and values. Alongside the school, parents play a significant role in their "home education" and upbringing. When one or both parents work away from home, their children miss care and supervision and become reluctant and unenthusiastic to go to school. Though most migrant parents work harder to pursue a better life and improve the living standard for their family members, the effect of their migration on their left-behind children's education should not be overlooked.

In China, over 61 million children are left behind by migrant parents, and almost half of them are left behind by both parents. Does parental migration lead to a better or worse outcome for these children? Existing literature has long highlighted various channels that parental migration would affect left-behind children's human capital development (Dustmann and Glitz, 2011). When migrant parents benefit from a higher income than before, the effect may not kick in until sometime later, or in the short term there may be significant cost to the family. Empirical evidence shows that remittance can effectively ease the original households' budget and reduce the rate of child labour; in addition, the extra money can be invested in children's education (Rapoport et al., 2006; Yang, 2008). However, parents' migration inherently leads to parental absence from home. The lack of parental inputs may constrain a child's psychological development. For example, some children may show a lacklustre attitude towards school and social interactions, which hinders their school performance.

Therefore, in this chapter, we aim to study the effect of parental migration on two outcome variables. They are child's school *performance*, as reported by the households, and education effort or input, namely participation in *private tutorial classes*. We ask: i) How does parents' migration affects a child's school performance? ii) Do migrant households attend more tutorial classes? In other words, do migrant households invest more on their child's education? (iii) Does it matter for the child as to who has migrated – father or mother or both? iv) What other factors might affect the child's education, and if so, do these factors significantly distinguish between migrants' children and non-migrants' children?

In addressing the above questions, we are confronted with the problem of endogeneity and omitted variable bias. As migration is likely to be motivated by desires to improve the child's wellbeing and education, any straight-forward comparison between migrant and non-migrant groups may be fraught with endogeneity problems. We therefore employ instrumental variable approach to identify the exogenous impact on migration and its consequent effect on education. Below we explain this in our discussion of the identification strategy.

We use the China Labor-force Dynamics Survey (CLDS, 2012) data in this chapter and observe 1,461 school-age children. The question of endogeneity arises in our main model, where we use our full sample that includes both migrant and non-migrant households. A household is defined migrant, if at least one of the parents has migrated leaving their child (children) behind. We identify that 442 of them have at least parent working away from home

while the rest 1,019 ones live with both parents.

Identification strategy: The migration decision could be influenced by the desire to improve children's education via remittances. Therefore, we need to look for exogenous variables that are related to migration decision but not to the child's education. Here, we follow the push-pull theory (Ravenstein, 1976) in migration studies and use two instruments: the crude out-migration probability (CMP) at the source location and the unemployment rate at the destination location. Both rates are arguably beyond the control of any individuals. They cannot possibly influence a child's educational achievement or input.

We consider two outcome variables, one as the achievement – children's school performance reported by the household, and the other as educational input or effort – participation in tutorials. The empirical strategy is IV estimations using 2SLS. For both outcomes, our IVs also meet the exclusion condition by checking their exogeneity using overidentification restrictions. Moreover, we also examine the subsamples to compare children's performance at different levels of education, at gender levels, and by which member of the household have migrated.

Results: Our first set of (IV estimate) results suggest that migrants' children *do perform differently* to the non-migrants' children. For the educational achievement, migrants' children perform poorly by 0.35 percentage points. In terms of the educational inputs, they are also less likely to participate in tutorials by 40 percentage points. The lower intake of the tutorial inputs

in turn disadvantage them.

Explanations for the outcomes are from two perspectives. One is that, due to parental absence, children lack parental care and supervision, which may be very important at least from emotional point of view, and in addition, they may have to devote some of their study time to household works. Thereby their learning is affected. The other perspective is that a migrant family may have irregular remittances, or even suffer a short-run loss in household incomes, before the migrating parent is able to send larger remittances. That means in the short run at least the family will be credit/cash constrained to participate in the tutorial market. In other words, even though the migration may end up enhancing incomes in the long run, there are significant short-run costs borne out by the family members, including the children. As most migrants are likely to be poorer in term of income in the first place, undertaking long-distance migration strains the family's budget even more.

The above findings provide a general idea of parental migration. We also concern the issue of "who migrates" and "how many members migrate". For that we identify the households where only the father, or the mother, or both parents have migrated. Here, we find an interesting picture. We see that when only one parent (either father or mother), the child's educational performance (i.e., test score) is worse than that in the situation where both parents migrate. Moreover, when only the mother migrates, the effect on the child's performance is the worst among all. This is not difficult to understand because mother's role is extremely vital in any household, and mother's involvement in any child's upbringing is crucial.

Compared to the case of one parent migrating, if both parents migrate then surprisingly the disadvantage in educational performance does no longer exists; the disadvantage is then confined only to the tutorial participation. Here, we do not have a clear explanation of why it is so; however, by looking at the data we see those households which have joint (or dual) migration also has extended family structure with grandparents or other close family members to care for the left-behind children. It seems that such arrangements are probably good social contracts through which the parents are able to more than compensate for their own absence. As for participation in the tutorials, which is essentially driven by the household's financial capacity, there is no difference between one parent's migration and two parents' migration.

Noticing the significance in children's characteristics, we then move forward to split our data in two subsamples, where the data are split by the levels of education and gender of the child. We see that it is at the senior high school level (slightly older children) there is no difference in outcomes. This is so because the senior age children may not be emotionally distressed by their (parent's or) parents' absence. But for younger children, who attend at the primary schools or junior high schools, the emotional stress can be significant. These children seem to perform significantly *poorly*, and they also have a significantly lower probability to attend private tutorials.

When we reconcile the subsample results with the full sample results, it appears that the full sample is dominated by young children, and hence we see the negative impact of migration at

the full sample level. We also see that parental migration indeed *hurts* girls' performance because they are required to take more time-consuming housework while there is no difference in boys' performance because they are preferable and well protected in China's patriarchal tradition; tutorial participation reveals no significant difference between boys and girls, and hence there is no gender discrimination issue in educational inputs.

Contribution: Our study contributes to not only the general parental migration effect on children, but also a specifically analysis of the family structure and children's characteristics, and thereby reveals more detailed effects from various aspects. Concerning China's unique national conditions and social status, we once again prove disadvantages of children living in migrants' households and the different treatments that boys and girls have received so that we expect more actions to be taken from the local government such as constructing the social care system and guaranteeing the educational opportunities to left-behind children. Besides, our empirical analysis points out the endogeneity issues and effectively combines the theory and practice to solve the problem. However, restricted by the survey design, we are unable to construct a panel format data so that we might fail to observe some time-variant factors.

The structure of the chapter is organized as follows. Section 2 reviews the literature and proposes hypotheses. Section 3 presents the data and descriptive statistics. Section 4 introduces the empirical strategy. Section 5 presents and discusses the estimation results. Section 6 concludes.

3.2 Conceptual Framework and Hypotheses

3.2.1 Migration effects on child's education

The existing literature argues that migration has both positive and negative effects on the left behind households and children. Stark and Bloom (1985) proposed the household strategy theory by which migration is an optimal strategy of the household to improve its welfare, primarily through remittances, which must be higher than the local area wage. Empirical studies show that migrant workers' remittances enhance the socioeconomic status of the household as well as improve the quality of life in various dimensions, such as better schooling of children, lower incidence of child labour, etc.. (Acosta et al., 2007; Amuedo-Dorantes et al., 2006; Edwards and Ureta, 2003; Mansuri, 2006; Wen et al., 2015; Wen and Lin,2012; Yang, 2008).

Yet, some studies also recognise that absence of parents has adverse effects. For instance, a child may have to undertake the household's farm or domestic work; an unsupervised child may slack on studies including on schooling attendance (Giannelli and Mangiavacchi, 2010). Therefore, we propose a nondirectional hypothesis on this relationship:

H_1: Parental migration has a significant effect on children's education in either direction.

Researchers also noted that a child's education may be affected not only by who migrates – father or the mother –, but also how many household members migrate. When the migrating

family member is the father (who is also more often the enforcer of discipline in daily studies), the child shows a less readiness to attend school (Antman, 2011; Biao, 2007; Booth, 1995). When the migrating parent is the mother or the primary caregiver in the family, the child takes on some of the roles of the mother and may become more responsible and caring. As a result of this, his/her academic performance and emotional behaviour may be significantly affected (Chang et al., 2011; Chen, 2013; Lahaie et al., 2009).

In terms of the numbers of migrating family members, if one parent migrates and the other one stays behind at the source location, he/she faces greater stress and more difficulties in providing high-quality parenting (Freistadt and Strohschein, 2013; Hannan and Halpin, 2014; Kiernan and Mensah, 2009; Kim, 2011; Lu et al., 2012; Perales et al., 2015). If both parents migrate, they seek the mutual help from a reliable extended family to look after left-behind children, therefore, these children should have no more social or economic problems relative to their peers living together with both parents (Baland et al., 2016; Bryant, 2005). Besides, one finding that is closely relevant to our work is that the child's educational performance follows the sibling chain of educational assistance in the extended family; that is, if one child performs better, he/she will tutor the other siblings/children in the family (Simons, 1994). Nevertheless, the care from the extended family to left-behind children can never replace the parental care; nor can it provide as much protection as parents do.

Since we still see both sides of the parental migration effects on children's education when different member or number of members migrate, we propose two nondirectional expectations

to this relationship:

H_{2a}: The effect of father's migration differs from the effect of mother's migration.

H_{2b}: The number of family members migrating affects the family's welfare.

3.2.2 Other factors

Another possibility often discussed by researchers is that children are affected differently by parental migration based on their age and gender. Since we just illustrate that parents play different roles in the household, when one or both are away, their children take different responsibilities following the tradition and the nature of the job in the households by gender. For instance, Meyerhoefer and Chen (2011) find that left-behind girls in China significantly lag behind in education because they sacrifice their studying as they have to spend more time on domestic work. Lee and Park (2010) find opposite effects on boys and girls when the father is the migrant. Similarly, Mckenzie and Rapoport (2011) find that older left-behind children in Mexico are expected to help with the housework, and more specifically, girls show a poor schooling performance, while boys are more likely to migrate themselves in their adulthood. On the contrary, Acosta (2011) shows the evidence that regular remittance to the original households reduce the child labour in El Salvador, and especially increase girls' schooling. Thus, we again expect a nondirectional but significant difference in children's educational outcomes from gender and age perspectives:

H_3: Parental migration will affect differently between young children and old children, and boys and girls.

3.3 Data Description

3.3.1 CLDS data

The data used in this chapter is from the 2012 China Labor-force Dynamics Survey (CLDS) implemented by Sun Yat-sen University Center for Social Survey (CSS)[6]. It is the first national (29 provinces except for Hong Kong, Macao, Taiwan, Tibet, and Hainan) labour-themed follow-up survey in China. CLDS focuses on interdisciplinary changes in China' labour such as education, employment, migration, health, and economic activities. CLDS data collected at village/community level, household level, and individual level. However, the first three rounds of data collection in the year 2010, 2012, and 2014 are not designed for the same group of observations for all three years but cross-examined different groups in different years. Besides, as the survey in the year 2010 is the first round so that many details are not included until the second round in the year 2012, while in the third round in the year 2014, many questions are omitted if those have appeared in the first two rounds. Thus, we are unable to construct a panel data using published CLDS data and therefore we choose the round in the year 2012 to investigate in this Chapter.

In the CLDS (2012) data, we are interested in the information regarding parental migration

6 The original survey and data can be found from the official website of Sun Yat-Sen University (http://css.sysu.edu.cn/Data/). Registration for data access; documentations freely downloadable.

and children's education. We primarily use the household survey and focus on children's education information, other household members' information (both away and home), and household's economic characteristics. The data also includes information about the distance from the household to the child's school (see Appendix 3.1 for original questionnaires). We consider only the school-age child in the family, or the first school-age child if the family has two or more children. Based on the questions (F4.26.11- F4.26.14) in the children's educational table (Table A3.1.1), we identify whether the child's father or mother is a migrant[7] and match the provided children's father and mother's codes to the household living/not living together members' information (Table A3.1.2 and Table A3.1.3). We also use the household code where the observed child lives in to match the household economic condition and other information sections. We filter all observations by location, and thus, all children in our data are at the source location. That is, left-behind children are those whose father or mother or both parents are away as migrants.

The child's educational outcomes observed from CLDS data are children's performance as the educational achievement, and tutorial participation as the educational input or effort. The child's educational performance is based on a performance ranking, from 1 very poor to 5 very good, provided by the family member who answered the survey. Though it is a subjective evaluation, it also refers to a reflection of children's actual test performance as well as the care and expectation from the family member. The tutorial participation is a combination of two

7 The definition of the migrant in CLDS is the household members who work away from home cities for more than 6 months.

types – attending after-school activities and extracurricular help, which reveals: i) the child's schooling performance – whether he/she is able to grasp additional skills and advanced knowledge or he/she performs poorly and needs extra help, and ii) the household wealth – whether the family can afford or is willing to invest in children other than tuition.

3.3.2 Descriptive statistics

Initially we have 3,079 observations from the children's educational table, however, due to a large amount of missing data on parents' information and household information, the number drops to 1,461, and of which 442 children live in the households with at least one parent migrates and 1,019 of which live in non-migrant households. We present descriptive statistics in Table 3.1 and a comparison between non-migrant and migrants' children with the significance level in Table 3.2. Among all 442 left-behind children, 314 of them have one parent away, of which in 86% cases (270 out of 314) the away parent is father and in 14% cases (44 out of 314) the away parent is mother; the remaining 128 children have both parents away. A very high proportion of our observations is from rural areas (94.1%); thus, in this chapter our focus is rural-to-urban migration.

We consider one educational *achievement* measure, which is school performance level on a scale to 1 to 5 (5 being the best) as reported by the household. The average performance of all children is 3.372, which is between "moderate" (score of 3 refers to "moderate") and "good" (score of 4 being "good") in our definition. The mean scores for the migrant and non-migrant

groups are 3.348 and 3.381, but the difference is not significant (Table 3.2).

We also consider an educational *input* – attending private tutorial classes. The overall tutorial participation rate is 32.2% for all children. That is, 492 children (out of 1,529) have attended tutorial – either for regular studies or for extracurricular activities. We notice that none of the children has attended both types of tutorial classes. The difference between the migrant and non-migrant households is now strongly significant. We see that non-migrant children have 12.5 percentage points higher rate of attending tutorial than migrants' children. In terms of specific types of the tutorial, both groups of children have a low rate of attending after-school activities, but still non-migrant children have a four times higher rate than migrants' children (8.4% vs. 1.9%), and this difference is significant. Similarly, both groups have a relatively high demand for "extracurricular help" (for non-migrant 27.3% vs. for migrant 21.3%). The higher demand from the non-migrant households is staggering.

In addition, we notice significant differences in household characteristics between the two groups. Most migrants' children are younger, receiving primary education, and a higher proportion of them have siblings (29.4%) – 6.8 percentage points higher than their non-migrant counterpart (22.6%). Given that the country's "one-child policy" has some exceptions[8] to rural families, this proportion is reasonable. The non-migrant parents have higher levels of education and the households' economic conditions are better off than migrants and their

8 The policy allowed many exceptions and ethnic minorities were exempt, i.e. if there were only one girl in the rural family, and at least one of the husband and wife was the only child, they can have two children (Law of the People's Republic of China on Population and Family Planning, China, 1980).

families. Since this chapter studies the children's education at the source location, there is no *hukou* barrier restricting the access to public school so that roughly 90% of children in both non-migrants and migrants' groups study in the public school. The same story applies to the home-school distance that most children attend the school inside of the city (more discussions in *hukou* restrictions can be found in Chapter 1, Appendix 1.1 & 1.2, and Chapter 2). Thus, we see no significant difference between non-migrants and migrants' children in terms of school type and school-to-home distance.

3.4 Model Specification

Our main interest is to investigate how parental migration affects left-behind children's education. Therefore, the estimation begins with a simple OLS model,

$$Y_i = \alpha_0 + \beta M_i + \boldsymbol{\theta}\mathbf{X}_i + \boldsymbol{\gamma}\mathbf{P}_i + \boldsymbol{\delta}\mathbf{F}_i + u_i \tag{3.1}$$

where the dependent variable Y is the educational outcome. We investigate the educational outcome from two perspectives: (i) children's educational performance, ranked from 1 (very poor) to 5 (very good); and (ii) children's tutorial participation, a binary outcome equals to 1 if the child attended the tutorial, otherwise 0. The effect of parental migration is captured by the coefficient β on M which is an indicator equal to 1 if one or both parents are migrants and 0 otherwise. The children's information, $\mathbf{X}$, is a set of control variables including children's age, gender, *hukou* type, whether have living together siblings, school type, and distance to the school. The parental educational level $\mathbf{P}$ includes two levels, mid and high,

referring to whether parents have a senior high school and university or above educational level respectively. The household economic condition **F** includes the housing condition and whether the household has debt.

However, as discussed earlier, the parents' migration decision is endogenous and their aspiration is unobserved; therefore, we use instrument variable (IV) approach and 2SLS estimation to fix the endogeneity problem. The first-stage regression is followed as,

$$M_i = a_0 + \boldsymbol{b}\mathbf{Z}_i + \boldsymbol{c}\mathbf{W}_i + v_i \tag{3.2}$$

where **Z** is a pair of instrument variables, crude out-migration probability[9] (CMP) at the source location and unemployment rate[10] at the destination location. **W** is a set of children, parents, and households control variables in previous models.

Two IVs are picked by following the push-pull theory (Ravenstein, 1976) in migration studies and the most popular IV – historical migration rate (Hanson and Woodruff, 2003; Hildebrandt and McKenzie, 2005; McKenzie and Rapoport, 2011) and variables relating to economic conditions at destination locations using in the existing literature (Amuedo-Dorante et al.,

9 Van Imhoff (1991) suggests that the intensity of migration from the census data should represent a probability rather than a rate, thus, the crude migration probability is the simplest measure of population migration intensity. The probability is then subdivided into crude in-migration probability and crude out-migration probability. Formulas are as follows,

$$\text{Crude in-migration probability: } \mathrm{CM_iP_A} = \frac{\mathrm{M_i}}{\mathrm{P_A}}$$

$$\text{Crude out-migration probability: } \mathrm{CM_0P_A} = \frac{\mathrm{M_o}}{\mathrm{P_A}}$$

where $\mathrm{M_i}$ is the immigrate population; $\mathrm{M_o}$ is emigrate population; $\mathrm{P_A}$ is the total population of province A. Population related data is collected from National Bureau of Statistics, China, http://data.stats.gov.cn.

10 Average unemployment rate between year 2006 to 2010, public data from National Bureau of Statistics, China, http://data.stats.gov.cn.

2008; Amuedo-Dorantes and Pozo, 2010; Antman, 2011; Cortes, 2004; Yang, 2008). Both rates are arguably beyond the control of any individuals. Besides, we use econometric tests to check the validity of IVs. The relevance condition is tested by checking the significance of $\boldsymbol{b}$ in the first-stage OLS estimation when migration decision is the dependent variable and two instruments along with all other controls are independent variables. Also, the robust F-statistics is checked to avoid weak instrument issue. We also use the robust Hausman test (Wooldridge, 1995) to confirm the endogeneity of the regressor and an overidentification test to confirm the exogeneity of two IVs (exclusion condition). We then obtain the fitted value $\widehat{M}_i$ from the first-stage regression and run the second-stage regression to produce $\hat{\beta}_{2\mathrm{SLS}}$.

Further, we examine the migration effect on children's educational outcomes in sub-samples using 2SLS estimations. (i) When different family member migrates: we aim to find how father migrating, mother migrating, or both parents migrating affects children's educational outcomes relative to non-migrants' children. (ii) How a general migration – one or both parents migrate – affects children's educational outcomes if they are in primary school, junior high school, or senior high school. (iii) How a general migration – one or both parents migrate – affects boys' or girls' educational outcomes. All control variables remain the same. Full variable description is presented in Table 3.1.

3.5 Estimation Results and Discussion

3.5.1 Non-IV estimates

We first report the baseline OLS/non-IV determinants of two educational outcomes – performance and tutorial participation (Table 3.3). The results show neither outcome is significant though the signs of the coefficients are opposite. As parental migration decision is correlated to some unobserved factors and therefore the OLS model may not be free from endogeneity issues, we adopt two instruments to address the endogeneity problem and to carry out IV estimations.

Table 3.3 Non-IV estimates (extract)

	(1)	(2)	(3)	(1)	(2)	(3)
OLS	Performance	Performance	Performance	Tutorial	Tutorial	Tutorial
Migrants	0.042	0.052	0.047	-0.037	-0.031	-0.018
	(0.048)	(0.048)	(0.048)	(0.025)	(0.025)	(0.025)
Children's controls	YES	YES	YES	YES	YES	YES
Parents' controls		YES	YES		YES	YES
Households' controls			YES			YES
Observations	1382	1382	1382	1399	1399	1399

See Table 3.3.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

* p < 0.1, ** p < 0.05, *** p < 0.01

3.5.2 IV estimates

Prior to the 2SLS estimation, we check the validity of two instruments – the crude out-migration probability (CMP) at the source location and the unemployment rate at the destination location. Conceptually, these two rates are unlikely to be influenced by an individual's decision to migrate or not; nor are they going to directly determine a child's educational achievement or input.

Table 3.4 IV Relevance Condition (extract)

Migrants	(1)	(2)	(3)
Migration rate (CMP)	0.052***	0.052***	0.051***
	(0.006)	(0.006)	(0.006)
Unemployment rate	-0.103***	-0.105***	-0.101***
	(0.020)	(0.020)	(0.020)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	1398	1398	1398
Robust F	44.013	44.489	42.884

See Table 3.4.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 3.5 IV estimates (extract)

	(1)	(2)	(3)	(1)	(2)	(3)
2SLS	Performance	Performance	Performance	Tutorial	Tutorial	Tutorial
Migrants	-0.336*	-0.337*	-0.355*	-0.413***	-0.402***	-0.400***
	(0.204)	(0.204)	(0.209)	(0.040)	(0.041)	(0.037)
Children's controls	YES	YES	YES	YES	YES	YES
Parents' controls		YES	YES		YES	YES
Households' controls			YES			YES
Observations	1381	1381	1381	1398	1398	1398
Robust Hausman	0.046	0.038	0.037	0.000	0.000	0.000
Sargan and Basmann	0.240	0.207	0.214	0.389	0.362	0.513

See Table 3.5.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 3.6 Correlation among migration status, educational expenses, and educational outcomes

	Migrants	Educational expense	Performance	Tutorial
Migrants	1			
Educational expense	-0.058**	1		
Performance	-0.018	0.038	1	
Tutorial	-0.114***	0.126***	0.043*	1

* p < 0.1, ** p < 0.05, *** p < 0.01

The first stage (Table 3.4) IV estimation results establish the relevance condition when two IVs become explanatory variables to the migration decision. Both IVs are strongly significant indicating that if the source location has 1% higher CMP, people are 5% more likely to migrate. But a 1% higher unemployment rate at the destination location reduces 10% the likelihood of migration. All the robust F-statistics are greater than 10 suggesting that we do not have weak instruments issue.

Now we report the parental migration effect on children's educational outcomes using 2SLS estimation (Table 3.5). We find that children's performance and tutorial participation are both negatively affected by their parents' migration status and therefore supports our first hypothesis (H_1) having a causal effect. Specifically, if at least one parent is migrating, his/her child's performance ranking is 0.35 point lower than a non-migrant child's performance. The probability of a migrant child's tutorial participation is 40 percentage point less than a non-migrant child's probability.

Given the above facts, we wonder whether and how the remittance impacts on the left-behind children's education. But our data do not have information on remittances. So, we consider children's educational expense as a proxy for remittance (assuming remittance should *increase* educational expenses) and check the significance of correlation coefficients between children's educational outcomes and expenses (Table 3.6). The results show that for the left-behind children educational expenses are significantly lower; the correlation between children's education efforts and expenses suggests that children's tutorial participation is

significantly and positively correlated with educational expenses.

How is then remittance and educational expenses related? We do not know whether the migrant households are experiencing a lower remittance or not in the survey year. But it is inconceivable that the migrant parents did not send remittances, although the money may come in irregular intervals. One reasonable conclusion is that whatever remittance was sent was not enough to overcome the income difference between the migrant and non-migrant households. Therefore, we have to say that migrant children lag behind the non-migrant children *despite* remittances. In addition to parental migration effects, we also find that two characteristics of children – levels of education and gender – show strongly significant effects. We shall discuss these in the later sub-sample section.

3.5.3 Sub-sample estimates

We now delve into some detailed aspects of migration, such as single parent migration and both parents migration. Table 3.7 shows the effect when only one parent (father or mother) or both parents migrate relative to non-migrants. The first two sets of results indicate that the left-behind child is more likely to perform poorly in the single-parent-household, because the single parent is under enormous pressure from both domestic and professional work so that it is hard for him/her to provide sufficient and high-quality parenting. As a consequence the left-behind child fails to receive proper supervision in education and in addition they may be expected to share the burden of some household work. Further, comparing between father and

mother's migration, we see that the magnitude of the impact of the mother's migration is almost twice as father's migration. It is hard to provide a credible explanation of this difference. We may speculate that when the mother is away, the home environment is poorly managed by the father and that possibly leads to much poorer performance by the child.

Table 3.7 IV estimates: different member migrates (extract)

	(1)		(2)		(3)	
	Performance	Tutorial	Performance	Tutorial	Performance	Tutorial
Migrants_father	-1.360**	-0. 461***				
	(0.573)	(0.030)				
Migrants_mother			-2.380*	-0.564***		
			(1.440)	(0.094)		
Migrants_both					-0.260	-0.392***
					(0.221)	(0.067)
Children's controls	YES	YES	YES	YES	YES	YES
Parents' controls	YES	YES	YES	YES	YES	YES
Households' controls	YES	YES	YES	YES	YES	YES
Observations	1282	1296	1070	1083	1091	1103
Robust Hausman	0.004	0.000	0.029	0.000	0.023	0.000
Sargan and Basmann	0.249	0.403	0.139	0.103	0.347	0.114

See Table 3.7.1 for full regression results.
The heteroscedasticity-robust standard error is reported in the brackets.
"YES" means the model includes that set of control variables.
"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.
"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Surprisingly, in the case of both parents migrating, the impact of migration is minimal – on both performance and tutorial, but more so on the tutorial. Possibly in these circumstances, the left-behind child is under the care and supervision of family members such as grandparents who are very likely to be the respondent to children's performance who can devote more time for the child. It is also possible that the stronger support from grandparents or extended family members is correlated with other factors not captured here. For example, such families may

have stronger support (both emotional and financial) system in the first place, which allows both parents to migrant. They may also have within family peers (such as cousins etc). Given our data limitations, we cannot pin down the channel of the impact. But the result is important to take note of.

Thus, our hypothesis regarding the migrating family member (H_{2a}) and numbers of members (H_{2b}) are proved through the educational performance channel, but we cannot tell a significant difference in terms of children's tutorial participation.

Other factors: Next we consider some other factors that may differentiate children's educational outcomes given the impact of a general parental migration (one or both parents migrating). First, we split the children by their levels of education. Under China's nine-year compulsory education system[11], the educational expenses vary at different levels of education. Also, according to the existing literature, children are affected at different ages, so next we classify children into three groups – receiving primary school level of education or no education, receiving junior high school level of education, and receiving senior high school level of education or higher education.

The results in Table 3.8 vary among three levels of education. The first set of estimation is the most consistent one because its size is the closest to the full sample. We find that when the

11 China's nine-year compulsory education system only covers children's tuition for 6 years of primary school education and 3 years of junior high school education. The senior high school education charges tuition and other fees (Compulsory Education Law of the People's Republic of China, 2006).

left-behind children are young (at primary school level), their performances are more likely to be negatively affected; and for those under compulsory education (primary and junior high school levels), they have approximately 40% lower probability of participating in tutorials relative to non-migrants' children. Given the universal exemption in tuition fees at the primary and junior high levels, younger children benefit from greater access to education; however, they also get emotionally affected by parental absence. For older children, i.e., at the senior high school level, they are less likely to be emotionally affected and possibly for that reason we do not see any differences between the migrants and non-migrants. They are performing and attending tutorials equally like the non-migrant children; however, since we lose a large number of observations (only 267 left), we fail to reject the robust Hausman test but do reject the overidentification test.

Table 3.8 IV estimates: children at different levels (extract)

	Primary school		Junior high school		Senior high school	
2SLS	Performance	Tutorial	Performance	Tutorial	Performance	Tutorial
Migrants	-0.516*	-0.459***	-0.535	-0.357***	0.854	-0.230
	(0.274)	(0.051)	(0.366)	(0.093)	(0.775)	(0.375)
Children's controls	YES	YES	YES	YES	YES	YES
Parents' controls	YES	YES	YES	YES	YES	YES
Households' controls	YES	YES	YES	YES	YES	YES
Observations	651	661	383	385	267	271
Robust Hausman	0.029	0.000	0.094	0.004	0.366	0.596
Sargan and Basmann	0.372	0.942	0.698	0.880	0.057	0.551

See Table 3.8.1 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.9 IV estimates: children in different gender (extract)

	Boys		Girls	
2SLS	Performance	Tutorial	Performance	Tutorial
Migrants	0.221	-0.383***	-1.111***	-0.428***
	(0.266)	(0.060)	(0.340)	(0.044)
Children's controls	YES	YES	YES	YES
Parents' controls	YES	YES	YES	YES
Households' controls	YES	YES	YES	YES
Observations	743	751	638	647
Robust Hausman	0.838	0.000	0.000	0.001
Sargan and Basmann	0.034	0.894	0.891	0.397

See Table 3.9.1 for full regression results.
The heteroscedasticity-robust standard error is reported in the brackets.
"YES" means the model includes that set of control variables.
"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.
"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.
* p < 0.1, ** p < 0.05, *** p < 0.01

Second, we split the children by their gender. The results in Table 3.9 show that the left-behind girls perform poorly that their ranking is 1.11 lower than non-migrants', whereas we see no significant migration effects on the boys. These results are also consistent with the existing literature and the fact that the patriarchal tradition and the underprivileged status of female in China – parents pay more attention to boys' study and it is girls who need to spend more time on housework, and the latter is more evident in migrants' families. Again, parental migration effects on boys' and girls' tutorial participation are similar without a significant difference – approximately 40% less participation for children in migrants' households; the reason is still the insufficient educational investment.

Hence, our hypothesis H_3 is proved that children at different levels of education have been affected differently in both educational outcomes while only the educational performance

shows the difference between different gender of children.

Regarding parents and household control variables, we find that children from urban areas have taken advantages of quality schools and facilities so that showing a significantly higher probability of performing good but no significant results in participating tutorials. Parents' high level of education background significantly improve children's performance and reduce tutorial participation as these parents can provide high-quality parenting as well as some family education. Household wealth affects variously but clearly indicates that a better condition can provide the child with a more suitable educational environment and surely households with debt will be restricted in their educational investment.

3.6 Conclusion

The most common migration in China is rural-to-urban. Most migrants are from low-income families and their purpose of migrating is to pursue a higher income. Therefore, to minimise the migration cost while maximise their working efficiency, more than 50% of migrant workers choose to leave their children behind. Due to the absence of parents' supervision and care, many left-behind children's education has been largely affected and they are likely to be lagged from their peers. In this chapter, we use cross-sectional data (CLDS, 2012) and IV estimations to investigate the left-behind children's schooling performance. The first-stage estimation shows that people are more likely to migrate if their places of origin have a high

out-migration rate, and less likely to migrate if their destination location has a high unemployment rate. The validity of two IVs has been checked and confirmed. Several findings of parental migration effect on children's educational outcomes are concluded below.

Once parental migration is instrumented, both children's educational outcomes, i.e., performance and educational efforts, become significant and negatively affected, showing a poor performance and low tutorial participation to the left-behind children. Specifically, we look at the role and the number of migrants in the household and find that one-parent migration results in the lack of supervision to the child, and single-parent can hardly provide sufficient and high-quality parenting but require the child to share the household burden. The worst scenario is when mother migrates alone, the child has not been well looked after, but been asked to undertake more housework. However, when children are left behind by both parents and stay with extended family, their educational performance seems has not been affected but more likely to be overestimated by relatives that much spoiling the child. The consistency of low participation rate in tutorial confirms the shortage in migrant households' wealth that they rather consume in the necessities.

After splitting children by their level of education and gender, we find that young left-behind and girls are mostly affected. Due to China's nine-year compulsory educational system, children under primary and junior levels of education are less invested as their parents are not expected to pay anything for children's education especially in the case of migrating parents who pay more attention raising the family rather than the child's education. Also, given the

patriarchal tradition in China, girls are less concerned in terms of educational performance but expected much more in helping housework relative to boys who are paid great efforts to be the future breadwinner of the family. Regarding other control variables, we see that children benefit from studying in urban schools, living in well-educated families and/or with good economic conditions – all of these features are positively related to children's human capital investment and therefore promote ones' development.

We also admit several limitations, which can be addressed in future work. Since we only observe the migration effect in one period with cross-sectional data, it may not be able to capture the time-variant factors, neither allows distinguishing temporary migrants and permanent migrant. Also, the children discussed in the chapter is the only or the first child in the household. It would be interesting to see how the migration affects other children, or how the living-together peers affect each other. Due to the data limitation, the children's educational performance may be inaccurately demonstrated as it is a subjective evaluation from the respondent, therefore, we examined together with tutorial participation and tried to avoid the potential bias.

Table 3.1 Descriptive Statistics

Variable	Description	Obs	Mean	SD	Min	Median	Max
Migrants	Parental migration status (dummy, migrant=1, non-migrant=0).	1461	0.303	0.460	0	0	1
Migrants_both	Father and mother both migrant (dummy, migrant = 1, non-migrant = 0)	1529	0.084	0.277	0	0	1
Migrants_mother	Mother's migration status (dummy, migrant = 1, non-migrant = 0).	1529	0.029	0.167	0	0	1
Migrants_father	Father's migration status (dummy, migrant = 1, non-migrant = 0).	1529	0.177	0.381	0	0	1
CMP	Crude out-migration probability at source provinces (in percentage).	1529	3.799	2.165	1.43	2.95	9.04
Unemployment rate	Unemployment rate at destination provinces (in percentage).	1528	3.586	0.607	1.68	3.7	4.36
Performance	Children's schooling performance (very poor = 1, poor = 2, moderate = 3, good = 4, very good = 5).	1509	3.372	0.826	1	3	5
Educational expense	Household educational expense on the child (Chinese Yuan in thousands).	1529	4.830	6.443	0	2.7	80
Tutorial	children's tutorial participation (dummy, attended = 1, not attended = 0).	1529	0.322	0.467	0	0	1
Activities	One type of tutorials (dummy, attended = 1, not attended = 0)	1518	0.063	0.243	0	0	1
Extra help	One type of tutorials (dummy, attended = 1, not attended = 0)	1518	0.254	0.435	0	0	1
Gender	Children's gender (dummy, boys=1, girls=0).	1529	0.530	0.499	0	1	1
Age	Children's age	1504	12.658	4.017	5	13	25
Grade	Children's grade (nursery = 0, primary school = from grade 1 to 6, junior high school = from grade 7 to 9, senior high school = from grade 10 to 12, junior college = 13, vocational college = 14, university = 15, graduated = 16).	1529	6.969	3.856	0	7	16
Hukou type	Children's hukou type (dummy, urban = 1, rural = 0).	1529	0.276	0.447	0	0	1
School type	Children's school type (dummy, public school = 1, private school = 0).	1488	0.888	0.316	0	1	1
Siblings	Children's living together sibling (dummy, have siblings = 1, no siblings = 0).	1529	0.243	0.429	0	0	1
School distance	Children's home-school distance (dummy, outside home city = 1, inside home city = 0).	1529	0.116	0.320	0	0	1
Condition	Household wealth proxy variable, continuous from 0 very poor condition to 10, low to very good condition.	1529	2.901	2.996	0	1	10
Debt	Household wealth proxy variable, (dummy, have debt = 1, do not have = 0).	1529	0.403	0.491	0	0	1
Low	Parental education variable, whether parents obtained junior high school education level (dummy, obtained junior high school = 1, else = 0).	1529	0.393	0.489	0	0	1
Mid	Parental education variable, whether parents obtained senior high school education level (dummy, obtained senior high school = 1, else = 0).	1529	0.164	0.371	0	0	1
High	Parental education variable, whether parents obtained higher education level (dummy, obtained higher education = 1, else = 0).	1529	0.150	0.358	0	0	1

Table 3.2 Difference in mean: non-migrants vs. migrants (t-test)

	Non-migrants (0)		Migrants (1)		mean-diff
Variable	Obs	Mean	obs	mean	(0-1)
Performance	1005	3.381	428	3.348	0.033
Education exp	1005	5.055	428	4.273	0.783**
Tutorial	1005	0.356	428	0.231	0.125***
Gender	977	0.525	422	0.566	-0.041
Age	977	12.716	422	12.251	0.465**
Primary school	977	0.454	422	0.514	-0.060**
Junior high School	977	0.281	422	0.261	0.021
Senior high School	977	0.197	422	0.190	0.007
Hukou type	977	0.342	422	0.126	0.216***
School type	977	0.894	422	0.865	0.029
School distance	977	0.123	422	0.090	0.033*
Siblings	977	0.226	422	0.294	-0.068***
Housing condition	977	3.322	422	1.839	1.484***
Debt	977	0.406	422	0.398	0.008
Parents mid edu	977	0.180	422	0.130	0.050**
Parents high edu	977	0.192	422	0.064	0.128***

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.3.1 Non-IV estimation (OLS)

	(1) Performance	(2) Performance	(3) Performance	(1) Tutorial	(2) Tutorial	(3) Tutorial
Migrants	0.042	0.052	0.047	-0.037	-0.031	-0.018
	(0.048)	(0.048)	(0.048)	(0.025)	(0.025)	(0.025)
Gender	-0.191***	-0.189***	-0.188***	-0.017	-0.015	-0.020
	(0.043)	(0.043)	(0.043)	(0.024)	(0.024)	(0.023)
Age	-0.018**	-0.018**	-0.018**	0.003	0.003	0.003
	(0.008)	(0.008)	(0.008)	(0.004)	(0.004)	(0.004)
Siblings	-0.056	-0.050	-0.045	-0.079***	-0.075***	-0.060**
	(0.054)	(0.054)	(0.054)	(0.027)	(0.027)	(0.026)
Hukou type	0.359***	0.292***	0.297***	0.257***	0.217***	0.068
	(0.050)	(0.057)	(0.066)	(0.031)	(0.035)	(0.043)
School type	0.050	0.048	0.046	0.057	0.058*	0.055
	(0.069)	(0.069)	(0.069)	(0.035)	(0.035)	(0.034)
School distance	0.073	0.048	0.040	0.034	0.019	-0.024
	(0.064)	(0.065)	(0.066)	(0.042)	(0.043)	(0.042)
Educational level						
Junior	-0.110**	-0.107*	-0.107*	0.127***	0.128***	0.124***
	(0.055)	(0.055)	(0.055)	(0.031)	(0.031)	(0.030)
Senior	0.087	0.091	0.090	0.159***	0.160***	0.154***
	(0.070)	(0.071)	(0.071)	(0.041)	(0.041)	(0.041)
Parents' education						
Mid		0.064	0.061		0.065*	0.043
		(0.060)	(0.061)		(0.035)	(0.034)
High		0.174**	0.175**		0.098**	0.033
		(0.070)	(0.071)		(0.043)	(0.043)
Household wealth						
Condition			-0.003			0.039***
			(0.010)			(0.007)
Debt			-0.086*			-0.044*
			(0.045)			(0.024)
Constant	3.570***	3.548***	3.598***	0.136***	0.120**	0.076
	(0.105)	(0.106)	(0.109)	(0.050)	(0.050)	(0.052)
Observations	1382	1382	1382	1399	1399	1399
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.060	0.063	0.064	0.113	0.117	0.146

The heteroscedasticity-robust standard error is reported in the brackets.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 3.4.1 IV relevance condition (OLS)

Migrants	(1)	(2)	(3)
Migration rate (CMP)	0.052***	0.052***	0.051***
	(0.006)	(0.006)	(0.006)
Unemployment rate	-0.103***	-0.105***	-0.101***
	(0.020)	(0.020)	(0.020)
Gender	0.035	0.033	0.035
	(0.023)	(0.023)	(0.023)
Age	-0.006*	-0.006*	-0.007*
	(0.004)	(0.004)	(0.004)
Siblings	0.011	0.007	0.004
	(0.029)	(0.029)	(0.029)
Hukou type	-0.179***	-0.132***	-0.077**
	(0.025)	(0.030)	(0.036)
School type	-0.032	-0.031	-0.031
	(0.037)	(0.037)	(0.037)
School distance	0.001	0.017	0.027
	(0.037)	(0.037)	(0.037)
Educational level			
Junior	0.004	0.002	0.004
	(0.029)	(0.029)	(0.029)
Senior	0.023	0.021	0.022
	(0.039)	(0.039)	(0.039)
Parents' education			
Mid		-0.047	-0.041
		(0.033)	(0.034)
High		-0.116***	-0.093**
		(0.035)	(0.036)
Household wealth			
Condition			-0.015***
			(0.005)
Debt			-0.035
			(0.024)
Constant	0.600***	0.623***	0.655***
	(0.092)	(0.091)	(0.092)
Observations	1398	1398	1398
Robust F	44.013	44.489	42.884
R-squared	0.117	0.122	0.128

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.5.1 IV estimation (2SLS)

	(1) Performance	(2) Performance	(3) Performance	(1) Tutorial	(2) Tutorial	(3) Tutorial
Migrants	-0.336*	-0.337*	-0.355*	-0.413***	-0.402***	-0.400***
	(0.204)	(0.204)	(0.209)	(0.040)	(0.041)	(0.037)
Gender	-0.174***	-0.172***	-0.170***	0.005	0.006	0.001
	(0.045)	(0.045)	(0.045)	(0.027)	(0.027)	(0.026)
Age	-0.021***	-0.021***	-0.021***	-0.001	-0.001	-0.000
	(0.008)	(0.008)	(0.008)	(0.004)	(0.004)	(0.004)
Siblings	-0.046	-0.042	-0.039	-0.063**	-0.062*	-0.049
	(0.056)	(0.056)	(0.056)	(0.032)	(0.032)	(0.031)
Hukou type	0.274***	0.225***	0.257***	0.148***	0.131***	0.022
	(0.065)	(0.067)	(0.071)	(0.042)	(0.043)	(0.047)
School type	0.034	0.032	0.030	0.038	0.039	0.038
	(0.071)	(0.071)	(0.071)	(0.041)	(0.040)	(0.039)
School distance	0.066	0.048	0.046	0.030	0.024	-0.012
	(0.066)	(0.066)	(0.067)	(0.046)	(0.046)	(0.046)
Educational level						
Junior	-0.112**	-0.110*	-0.109*	0.126***	0.127***	0.123***
	(0.056)	(0.056)	(0.056)	(0.034)	(0.034)	(0.033)
Senior	0.097	0.100	0.101	0.171***	0.171***	0.166***
	(0.072)	(0.073)	(0.073)	(0.047)	(0.047)	(0.046)
Parents' education						
Mid		0.039	0.039		0.032	0.016
		(0.062)	(0.063)		(0.040)	(0.038)
High		0.127*	0.139*		0.038	-0.009
		(0.073)	(0.073)		(0.048)	(0.048)
Household wealth						
Condition			-0.011			0.029***
			(0.010)			(0.007)
Debt			-0.104**			-0.062**
			(0.046)			(0.027)
Constant	3.740***	3.728***	3.804***	0.363***	0.356***	0.322***
	(0.136)	(0.138)	(0.147)	(0.076)	(0.077)	(0.082)
Observations	1381	1381	1381	1398	1398	1398
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
Robust Hausman	0.046	0.038	0.037	0.000	0.000	0.000
Sargan and Basmann	0.240	0.207	0.214	0.389	0.362	0.513

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.7.1 IV estimates: different member migrates (2SLS)

	(1)		(2)		(3)	
	Performance	Tutorial	Performance	Tutorial	Performance	Tutorial
Father migrants	-1.360**	-0. 461***				
	(0.573)	(0.030)				
Mother migrants			-2.380*	-0.564***		
			(1.440)	(0.094)		
Both migrants					-0.260	-0.392***
					(0.221)	(0.067)
Gender	-0.160***	0.009	-0.199***	0.023	-0.236***	-0.026
	(0.054)	(0.036)	(0.060)	(0.040)	(0.049)	(0.028)
Age	-0.020**	-0.002	-0.019**	-0.000	-0.021**	-0.003
	(0.009)	(0.005)	(0.010)	(0.006)	(0.009)	(0.004)
Siblings	-0.074	-0.063	-0.005	-0.047	-0.055	-0.068**
	(0.068)	(0.044)	(0.082)	(0.052)	(0.064)	(0.032)
Hukou type	0.158	-0.030	0.257***	0.034	0.273***	0.055
	(0.097)	(0.067)	(0.082)	(0.055)	(0.074)	(0.047)
School type	0.019	0.002	0.102	0.078	0.029	0.055
	(0.090)	(0.057)	(0.095)	(0.062)	(0.081)	(0.043)
School distance	-0.019	-0.064	-0.041	-0.094	0.042	-0.007
	(0.082)	(0.055)	(0.084)	(0.059)	(0.070)	(0.048)
Educational level						
Junior	-0.121*	0.126***	-0.138*	0.134***	-0.134**	0.128***
	(0.065)	(0.043)	(0.072)	(0.049)	(0.063)	(0.035)
Senior	0.071	0.184***	-0.031	0.101	0.052	0.107**
	(0.088)	(0.062)	(0.092)	(0.063)	(0.083)	(0.047)
Parents' education						
Mid	0.044	0.022	0.004	0.027	-0.011	0.025
	(0.077)	(0.050)	(0.084)	(0.056)	(0.069)	(0.039)
High	0.139*	0.034	0.105	0.015	0.128	-0.009
	(0.080)	(0.058)	(0.087)	(0.057)	(0.083)	(0.050)
Household wealth						
Condition	-0.018	0.024**	-0.004	0.028***	-0.004	0.030***
	(0.012)	(0.010)	(0.013)	(0.009)	(0.011)	(0.007)
Debt	-0.117**	-0.065*	-0.039	0.007	-0.091*	-0.082***
	(0.056)	(0.036)	(0.064)	(0.044)	(0.053)	(0.030)
Constant	4.012***	0.473***	3.707***	0.211**	3.770***	0.271***
	(0.233)	(0.147)	(0.155)	(0.097)	(0.136)	(0.073)
Observations	1282	1296	1070	1083	1091	1103
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
Robust Hausman	0.004	0.000	0.029	0.000	0.023	0.000
Sargan and Basmann	0.249	0.403	0.139	0.103	0.347	0.114

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.8.1 IV estimates: children at different levels (2SLS)

	Primary school		Junior high school		Senior high school	
	Performance	Tutorial	Performance	Tutorial	Performance	Tutorial
Migrants	-0.516*	-0.459***	-0.535	-0.357***	0.854	-0.230
	(0.274)	(0.051)	(0.366)	(0.093)	(0.775)	(0.375)
Gender	-0.126*	0.020	-0.264***	-0.076	-0.234**	-0.001
	(0.070)	(0.034)	(0.082)	(0.055)	(0.110)	(0.077)
Age	-0.011	0.019***	-0.079***	0.001	0.008	-0.020
	(0.016)	(0.007)	(0.027)	(0.013)	(0.034)	(0.022)
Siblings	-0.106	-0.065	0.064	-0.041	0.133	-0.041
	(0.091)	(0.040)	(0.110)	(0.064)	(0.120)	(0.084)
Hukou type	0.335***	-0.000	0.154	0.080	0.092	0.002
	(0.109)	(0.062)	(0.129)	(0.097)	(0.226)	(0.132)
School type	-0.097	0.013	0.154	0.033	0.315**	0.061
	(0.102)	(0.046)	(0.136)	(0.083)	(0.157)	(0.137)
School distance	0.076	-0.036	-0.033	-0.013	0.111	-0.002
	(0.102)	(0.068)	(0.151)	(0.090)	(0.137)	(0.104)
Parents' education						
Mid	0.068	0.040***	-0.016	0.024	-0.008	0.016
	(0.101)	(0.010)	(0.122)	(0.015)	(0.137)	(0.017)
High	0.178	-0.109***	0.141	-0.070	-0.227	-0.007
	(0.122)	(0.036)	(0.118)	(0.056)	(0.183)	(0.071)
Household wealth						
Condition	-0.019	0.032	-0.015	0.083	0.060**	-0.004
	(0.016)	(0.052)	(0.020)	(0.077)	(0.027)	(0.084)
Debt	-0.122	-0.095	-0.147	-0.045	-0.152	0.193
	(0.077)	(0.067)	(0.090)	(0.098)	(0.119)	(0.125)
Constant	3.853***	0.185**	4.530***	0.504**	2.694***	0.677*
	(0.202)	(0.090)	(0.415)	(0.236)	(0.677)	(0.405)
Observations	651	661	383	385	267	271
Prob>chi2	0.000	0.000	0.000	0.000	0.099	0.101
Robust Hausman	0.029	0.000	0.094	0.004	0.366	0.596
Sargan and Basmann	0.372	0.942	0.698	0.880	0.057	0.551

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.9.1 IV estimates: children in different gender (2SLS)

	Boys		Girls	
2SLS	Performance	Tutorial	Performance	Tutorial
Migrants	0.221	-0.383***	-1.111***	-0.428***
	(0.266)	(0.060)	(0.340)	(0.044)
Age	-0.024**	0.003	-0.019	-0.004
	(0.010)	(0.006)	(0.012)	(0.006)
Siblings	-0.004	-0.074*	-0.061	-0.024
	(0.078)	(0.045)	(0.087)	(0.042)
Hukou type	0.224**	-0.015	0.268**	0.071
	(0.094)	(0.067)	(0.111)	(0.069)
School type	0.034	0.024	-0.016	0.054
	(0.089)	(0.054)	(0.127)	(0.054)
School distance	0.036	-0.004	-0.007	-0.024
	(0.090)	(0.063)	(0.105)	(0.066)
Educational level				
Junior	-0.148*	0.064	-0.038	0.188***
	(0.076)	(0.046)	(0.087)	(0.047)
Senior	0.132	0.144**	0.060	0.188***
	(0.097)	(0.067)	(0.115)	(0.063)
Parents' education				
Mid	0.114	0.023	-0.098	0.010
	(0.077)	(0.052)	(0.113)	(0.055)
High	0.245**	0.007	0.058	-0.049
	(0.100)	(0.067)	(0.116)	(0.070)
Household wealth				
Condition	0.015	0.028***	-0.043***	0.033***
	(0.014)	(0.011)	(0.016)	(0.010)
Debt	-0.046	-0.053	-0.152**	-0.064
	(0.062)	(0.037)	(0.074)	(0.039)
Constant	3.365***	0.325***	4.169***	0.306***
	(0.188)	(0.115)	(0.256)	(0.114)
Observations	743	751	638	647
Prob>chi2	0.000	0.000	0.000	0.000
Robust Hausman	0.838	0.000	0.000	0.001
Sargan and Basmann	0.034	0.894	0.891	0.397

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix 3.1 Relevant survey questions in CLDS

Table A3.1.1 Children's educational table

Children Educational Table						
Conditions	Options	1 _____	2 _____	3 _____	4 _____	5 _____
F4.26.1 Household registration type	1. Agricultural household registration 2. Non-agricultural household registration					
F4.26.2 Location of school	___ Province ____ City (county)					
F4.26.3 At present, who is the student' s care giver?	Person code of caregiver (Indicate the person code of the primary caretaker; write down 0 if a caretaker is not					
F4.26.4 The educational level of the child as of September 2012	The child will be attending ______					
F4.26.5 The type of school attended by the child	1. Private school 2. Public school					
F4.26.6 Academic achievement of the student	1. Very good 2. Good 3. Moderate 4. Poor 5. Very poor					
F4.26.7 Has the child ever attended tutoring classes?	1. Yes 2. No (please skip to F4.26.8)					
F4.26.7a The type of tutoring class attended	1. Math Olympiad class 2. Curriculum extension class 3. Interest & hobbies class 4. Other					
F4.26.8 Has the child ever had a part-time job that provided him/her income?	1. Yes 2. No					
F4.26.9 Has the child ever performed volunteer work?	1. Yes 2. No					
F4.26.10 Total educational expenses of the child (i.e., tuition and incidental expenses,	__________ yuan per year					
F4.26.11 The person code of the child' s father (as listed under T1 and T2)						
F4.26.12 The person code of the child' s mother (as listed under T1 and T2)						
F4.26.13 Is the child' s father a migrant worker?	1.Yes 2.No					
F4.26.14 Is the child' s mother a migrant worker?	1.Yes 2.No					

Table A3.1.2 Living together household members table (T1)

T1 Living Together Household Members Table														
code	Name	Relationship with 101	Year of Birth	Gender	Ethnicity	Marital status	Level of education	Health status	Household registration type	Place of registered residence	Date that co-residence began	Employment status	Main occupation	Industry type
101 resp.														
102														
103														
104														
105														
106														
107														
108														
109														
110														
301														
302														
303														
304														

Table A3.1.3 Not living together household members table (T2)

T2 NOT Living Together Household Members Table																					
code	Name	Relation with 101	Year of Birth	Gender	Ethnicity	Marital status	Spouse Code	Level of education	Health status	Date of residence separation	Current city/county of residence	Household registration type	Place of registered residence	Employment status	Main occupation	Industry type					
201																					
202																					
203																					
204																					
205																					
206																					
207																					
208																					
209																					
210																					
211																					
212																					

Chapter 4

Parental Migration and Child Health: A Source Location Study in China

Summary: Looking at the household survey data of 2010 and 2014 covering largely, but not exclusively, rural China we try to analyse the effects of parental migration on the left-behind child's physical and mental health, as well as self-reported heath – a perception of well-being. While the ordinary least square estimates show no difference between migrant and non-migrant child, instrumental variable (IV) method reveals a different picture. The IV estimates show that compared to the non-migrant children, migrant children are likely to be more underweight and mentally depressed. Further investigation shows that father's and mother's migrations do not always have the same effect on the child. While father's migration may have an adverse mental health effect, mother's migration surprisingly may not have any effects.

Although we cannot pin down the causes of this, we conjecture that it could be due to a difference in their time allocation between work, while away from home, and maintaining contacts with the child. We also see that when both parents are away, the child feel mentally depressed, but not necessarily physically unwell. These effects of migration are not always visible in both time periods, or for both genders of the child or across all age groups. But the overwhelming picture is the one of negative physical and mental health effects on the children.

4.1 Introduction

Migration is a complex phenomenon that touches on a multiplicity of economic, social, and security aspects affecting our daily lives in an increasingly interconnected world. It is also a term that encompasses a wide variety of movements and situations involving people of all lifestyles and backgrounds. Among all the international migrants in 2015, 40% of them originated from Asia. It is also the case that within-county migration is significantly high in Asia. This has most notably been the case in China, where the economic and social reforms of the 1980s initiated one of the largest human migrations in history. The type of migration in China is labour migration that hundreds of millions of underemployed peasants left the countryside for the cities, driven by the prospect of employment opportunities and higher incomes. Statistics from the International Organization for Migration shows that migrant population in China had increased from 221 million in 2010 to 247 million in 2015.

One issue related to migration is the effect on the migrants' children. Some migrants bring their children to the destination place, while others leave them behind at their native place. In 2015, within China 34.26 million children migrated with their parents and 68.7 million children stayed at home while their parents were away, accounting together for 38% of the country's child population. Existing literature has long highlighted the various channels through which the parental migration would affect the left-behind children's human capital development (Dustmann and Glitz, 2011). On the one hand, migrant parents' total income increases and the remittance from the income could ease the household budget constraint and allow them to invest in child's nutrition. On the other hand, parents' migration inherently has some psychological impacts on the child.

However, previous studies examined a very limited set of child health outcomes and often in incomplete health dimensions. For example, they studied the child's physical health only from the anthropometric perspectives, or child's mental health only by examining non-cognitive skills. In addition, most existing studies have not paid attention to the parents' migration status, which can be negative psychologically and at the same time positive from a physical health point of view, because of better nutrition. In this chapter, we aim to fill these gaps by considering both the child's physical and mental health, along with the parental migration status. We also include child's own perception of his/her own health by incorporating self-reported health status. Thus, we study the child health issue in a much broader dimension than previously done for China.

We aim to answer the following questions: i) Whether parental migration affects the physical and mental health of the left-behind children? ii) Is the effect of migration different if mother migrates as opposed to father, or if both migrate leaving the child to their extended family? iii) What other factors might affect the child health, and if so, do these factors significantly distinguish between migrants' children and non-migrants' children?

To answer these problems, we first establish a conceptual framework and propose a potential relationship between parental migration and children's health. The key hypothesis is that we expect a significant effect of parental migration on left-behind children's health, but the direction of the effect differentiates in terms of children's physical health, mental health, and self-reported health. We use two cross-sectional data in the year 2010 and 2014 from China Family Panel Studies (CFPS) to carry out the empirical analysis. We have a total number of 1,042 and 1,562 observations, and among which we identify 175 and 269 observations are left-behind children whereas 867 and 1,293 observations are non-migrants' children, respectively for the year 2010 and 2014.

Physical health: We study three different physical health outcomes, namely underweight, overweight, and illness. The first two indicators are defined based on the BMI data of the children and using the Centers for Disease Control and Prevention (CDC) BMI-for-age cut-off points for overweight and underweight (which use the same formula as WHO but slightly different distribution for children and teens). The third outcome, that is of illness, is a self-reported data of the household. All of these outcomes binary – "yes" or "no" type. Appendix

4.1 gives the detailed distribution of the boys' and girls' BMI data.

Mental health: For mental health, we study only one outcome – "tendency of depression". This outcome is defined by combining two sets of mental health data received via two different sets of questionnaires, which are Center for Epidemiologic Studies Depression Scale (CES-D) and Kessler Psychological Distress Scale (K6). These two surveys were conducted in alternative years. Using K6 as our benchmark question, we use CES-D for matching questions for the other years. This allows us to gather three years of data on mental health. Then we use the standard cut-off (as given by K6) to identify a child having a tendency of depression or not. The details of the above measures are given in Appendix 4.2.

Finally, we also consider a more inclusive indicator, children's self-reported health status, to examine children's general health – "healthy" – to represents both respondent's physiological function and psychological status. The outcome is from a 5-scale self-reported health status from very unhealthy to very healthy and further formed into the binary outcome that if children consider themselves healthy (scale 4) and very healthy (scale 5), the outcome equals to 1 as "healthy", otherwise equals to 0 as the outcome is "unhealthy". All health indicator details are provided in section 4.3.2. Thus, using all these health indicators in all dimensions along with children's, parents', and households' characteristics allows us to fully investigate the left-behind children's health outcomes.

Identification strategy: A child's health is related to his/her parents' health, especially mother's,

but also to nutrition, diet, etc. which are dependent on the family's income. When a parent is the migrant, it can be assumed that he/she has met basic work standards and abilities without serious health issues. As migrant's main objective is to get a higher income, such families are most likely to be at the bottom half of the income distribution in their area. Thus, some omitted variables may correlate with the migration decision, and we need to rectify that. The decision to migrate may also be influenced by providing more food or a better diet for the family members, which can cause a selection bias. Thus, we need to instrument the migration status. We use two provincial-level instruments, crude migration probability (CMP) and the number of public transport vehicles for every 10,000 people at the source location. Both instruments are aggregative and beyond the influence of an individual household and have been tested econometrically that exogenous to children's health status.

Results: Our results suggest that left-behind children have overall poor health relative to non-migrant children. The details are as follows. First, having a migrant parent increases the likelihood of the child being *underweight* and simultaneously reduces the likelihood of being *overweight*. This is consistent with children's BMI distribution as well as the general picture that migrants are economically worse off, and the family may receive irregular remittances, which can affect the child's nutrition. In addition, we also find that migrants' children are weak and the probability of *illness* is higher than non-migrants' children. Similar results are also found by other researchers, for instance, Stillman et al. (2012) exploit a migration lottery in New Zealand and find that the diet habit and health outcome for migrants' children are worse. Second, the mental health is also more likely to be poorer for migrant children, i.e., they

are more likely to have the tendency of depression. Perhaps parental absence is taking its tolls on the child's psychology. Poor physical and mental health have also been reflected in the children's self-reported health condition. Migrants' children are more likely to report poor health than children in non-migrants' households. Third, given who has migrated – father or mother –, children are differently affected. Mother's migration affects the child's health more seriously than father's migration. This is not surprising, because mother is the primary care giver in the family, while father's care giving role is secondary. However, when both parents migrate the effect seems to be least serious. We assume that this is because strong family ties of the extended families help to overcome the absence of both parents.

Finally, we also investigate how the migration effect varies with child's age, gender, and location. We find that the older children are more likely to have underweight problems, because they fail to get adequate nutrition required for their age due to the lower incomes of their households. On the other hand, the younger children have a higher probability of being depressed, because separation from parents hurts them much more than the older children. In sum, the older children are likely to suffer in terms of physical health, while the younger children are likely to suffer mental illness.

Between boys and girls, the girls bear a greater burden of the household chores and play the roles of the parents; therefore, they are more likely to be physically weakened and mentally stressed out than the boys. We also see that the situation is generally a lot better in urban areas due to the presence of well-established social care and high-quality schooling; in rural areas

left-behind children suffer more compared to their urban cohorts. A similar result has been found by Wang and Mesman (2015) that the rural left-behind children are easily irritated and intransigent.

Contribution: This chapter studies, with sufficient attention given to endogeneity, left-behind children's health status from physical, mental, and general health dimensions, and with great attention given to the details of migration such as "who migrates" and "how many migrate" from a household. By integrating both, we see a comprehensive picture. Further, we differentiate children by their characteristics and study the differential effects of migration on them. Our study also helps to understand the unbalanced nature of the Chinese social welfare system and some of the disadvantages of the *hukou* system. The *hukou* system discourages people to take their family with them; our study shows that this puts their children under stress.

The structure of this chapter is organized as follows. Section 2 reviews the existing literature and propose hypotheses. Section 3 presents the data and descriptive statistics. Section 4 introduces the empirical strategy and variables. Section 5 reports and discusses the estimation results. Section 6 concludes.

4.2 Conceptual Framework and Hypotheses

4.2.1 Migration effects on children's physical health

The consequences of parental migration on left-behind children's physical health can be double-edged. Remittance sent by migrants relaxes the household's burden at the source location and therefore invest more in nutritious food, such as fruits, vegetables, eggs, and meat (Subramanian and Deaton, 1996; Nguyen and Winters, 2011). Most researchers find that migrants' children are fitter and healthier, measured by height-for-age and weight-for-age, and even increase the infant survival rate (Berrington de Gonzalez et al., 2010; Mansuri, 2007; Kanaiaupuni and Donato, 1999). However, the decision of sending or using the amount of remittance has been affected by different roles in a family, usually referring to the father and mother. If both father and mother migrate and they aim to maximise the household's happiness, the father prefers to invest in physical assets while the mother prefers to invest in the human capital and more amount in percentage and overall of her income (Richter and Havanon, 1995; Phongpaichit, 1993). If only one parent migrates, for instance the father, and the mother left-behind assumes to be more "powerful" in the resource allocation and usage of household income (Acosta, 2007). Moreover, remittance also refers to social remittance – the ideas, behaviours, identities, and social capital flow from the destination location to the source location (Levitt, 1998). Migrants not only provide financial support to their original households but also bring back new information or advanced knowledge to the left-behind family members. Therefore, we expect a nondirectional parental migration effect on left-behind children's physical health:

H_1: Parental migration has a significant effect on children's physical health.

4.2.2 Migration effects on children's mental health

Regarding children's mental health, a large body of research concludes an adverse effect of parental migration. One of the most crucial elements that affect children's cognitive and social-emotional outcomes is the quality of parenting (Steinberg, 2001). High-quality parenting behaviour needs a combination of warmth, responsiveness, affection, and support with appropriate control and discipline (Baumrind, 1986; Brooks-Gunn and Markman, 2005). However, when children grow in a single-parent or non-immediate household whilst the parent is less emotionally supportive, or we say providing poor parenting, the outcome of these children is on average worse-off. They show more emotional problems, more inferior abilities, lower self-esteem, and have more difficulties in maintaining social relationships than children under the good quality of parenting (Amato, 2005; Freistadt and Strohschein, 2013; Hannan and Halpin, 2014; Kiernan and Mensah, 2009; Kim, 2011; McLanahan and Sandefur, 1994; Perales et al., 2015). Since parental migration significantly changes the family structure, it directly leads to poor parenting to the left-behind child.

Evidence from China shows that over 97% of the children in a single-parent or even neither-parent household are caused by labour migration (Ren and Treiman, 2016). Lu et al. (2012) interview single-parents at the source location and find that most of the single-parents face great stress and difficulties in providing high-quality parenting, further, themselves show a high likelihood of depression. Children living in a household with a depressing atmosphere and bearing a passive attitude from the single-parent have severely affected their mental health. More seriously, children living with neither parents have rare emotional support from parents, and thus they are easily irritated and intransigent and have lower self-esteem than children

living with both parents do (Chan and Crothall, 2009; Graham and Jordan, 2011; Lee and Park, 2010; Wang and Mesman, 2015; Zhang et al., 2018). Though migrating parents seek to maintain regular contacts with the left-behind children via telephone or internet, the family relationship is not close, and still fewer than 30% of left-behind children meet their migrant parents in person every year (Ye and Murray, 2005).

One non-profit organization in China, On the Road to School, publishes annually "White Papers of the left-behind children's mental health in China". In their latest white paper (2018), they find that more than 40% of left-behind children meet their migrant parents less than twice a year. The biggest problem faced by left-behind children is not economic difficulties, but psychological problems caused by long-term separation from their parents – they even show resentment against parents. According to their survey data, more than 10% of the left-behind children have chosen to say that their parents are dead, which is not the fact. Therefore, strengthening the relationship between children and parents and constructing social welfare on left-behind children are vitally important.

Thus, we hypothesized a negative relationship between migration and children's mental health:

H_2: The left-behind children at the source locations will show significantly more emotional problems and a higher probability of mental illness than non-migrants' children.

4.2.3 Migration effects on children's general health

At last, as self-assessment of children's general health (self-reported health status, SRHS) is investigated. It is first a reflection of the medical diagnosis that people suffering from illness or disability are likely to rate a low health scale, and also related to the mental health that a positive attitude to life and self-expectation usually results in a high scale (Ghorbani Saeedian et al., 2014; Johnson and Wolinsky, 1993; Jylhä, 2009; Shields and Shooshtari, 2001; Sun et al., 2011). Since it has been affected by both objective health status and subjective cognition such as feelings and culture background, self-reported health status may not fully correspond to the objective physical or mental health. Thus, we again expect a non-directional relationship between parental migration and left-behind children's health:

H_3: The self-reported health status' rating from the left-behind children will have a significant difference to the rating from non-migrants' children.

4.2.4 Other factors

Researchers also find additional effects on children's health when different members migrate, especially in the case of the mother or both parents' migration. One has been discussed earlier, the use of remittance depends on who migrates and who is left behind, and therefore resulting in different investment. The other one is that, since the mother is the primary caregiver in the family and deals with the domestic work, if she is away, the child is vulnerable to cold, cough, stomach ache, headache, loss of appetite, and the health expenditure on his/her breastfeeding and vaccinations is lower (Chinese Center for Disease Control and Prevention, 2010; Hildebrandt and McKenzie, 2005; Konseiga et al., 2009). When both parents migrate, the left-

behind children are looked after by grandparents or an extended family, but such care is never equivalent to the care from parents. For instance, the grandparents are mostly over 50 years old with a low level of education or even illiteracy in rural China where most migrants come from. They lack nutritional knowledge but spoil and indulge the child in some occasions (Liu et al., 2006). Gibson et al. (2011b) find that children living with the extended family have poor diet habit and health outcome; they are often asked to do more household chores as a result of which they are more likely to be underweight. Thus, the non-directional hypothesis is:

> H_4: Parental migration effects differ between the father and mother's role in the family as well as whether both father and mother are away.

Concerning children's characteristics, researchers indicate two particularly – age and gender. De Brauw and Mu (2011) find that older children (age 7 to 12) in migrant households are more likely to be underweight, which is because they do more household chores, while younger children (age 2 to 6) are less likely to be overweight if the caregiver is not grandparents. Chen (2000) finds that non-breastfeeding and non-mother care children under the age of 5 have exposed to high risks of malnutrition. Zhan et al. (2014) find both parents' migration affects 12-15 years old children's mental health the most and the effect is more evident to girls. Rubalcava et al. (2008) investigate Mexican migrants' health using their self-reported health status and find substantial variation between males and females and between urban and rural dwellers. Like the Chinese *hukou* policy, migration effects also differ between rural – urban migration and urban – urban migration (Fan, 2009; Fan & Wang, 2008). In most cases people migrate from rural to urban areas to pursue the opportunities of higher income and better living.

Some also migrate from one urban area to another for the benefit of their offspring (Boucher et al., 2009; Brauw and Giles, 2016; Docquier and Rapoport, 2012; Kong and Meng, 2010; Sun et al., 2015). Therefore, we expect a non-directional but significant difference in children's different characteristics:

H_5: Parental migration will affect differently between young children and old children, boys and girls, and rural and urban children.

4.3 Data Description

4.3.1 CFPS data

The data used in this chapter is from China Family Panel Studies (CFPS), which is a nationally representative, annual longitudinal survey of Chinese communities, households, and individuals by the Institute of Social Science Survey (ISSS) of Peking University, China[12]. The CFPS is designed to collect individual-, household-, and community-level longitudinal data in contemporary China and collects large samples of data covering 623 communities, 14,960 households, and 42,590 individuals (33,600 adults and 8,990 children). The studies focus on the economic, as well as the non-economic, wellbeing of the Chinese population, with rich information covering topics such as economic activities, education outcomes, family dynamics and relationships, migration, and health. The CFPS surveys collected data from 25

12 The original survey and data can be found from the official website of Peking University (http://www.isss.pku.edu.cn/cfps/). Registration for data access; documentations freely downloadable.

provinces/cities/autonomous regions in China (excluding Hong Kong, Macao, Taiwan, Xinjiang, Tibet, Qinghai, Inner Mongolia, Ningxia and Hainan), which represent 95% of the Chinese population (Figure 4.1).

CFPS defined a "household" as an independent economic unit living in the traditional residential area with at least one Chinese nationality citizen. Household members should economically tie to the sample household, explicitly referring to immediate family members, or non-immediate family members who have a blood/marriage/adoptive relationship with the household and has continuously living together for more than 3 months. In addition, CFPS specially designed a section to collect information for the "out" family members who are physically residing at a difference for more than three months but still economically bonded to the respondent family (the same as the defined "household" in the survey). The reason for the family member is out can be for studying, working, being a monk, visiting relatives and friends, serving the army, and living abroad, but here we only consider the working "out" family member. Thus, the definition of "migrant" in this chapter becomes a person who out-migrate to other places for working purpose; he/she remains economic connection to the household but no longer living together for more than 3 months.

Though we benefit from the large sample size and the wide range of information in CFPS, it also makes it difficult to cleansing and mining the data. The objective in this chapter is to examine how migrating parents affect left-behind children's health, therefore, the priority is to

identify the left-behind children and their parents. We start with the children's survey[13] and match their parents' codes to the adult's survey if the child lives together with parents (as non-migrant household); or we match the parents' codes to the household survey and identify the family members' information provided by the respondent if one or both parents are migrating. Besides, we match all children's surveys to the household survey to pick up the household characteristics. Though we have a full sample of children physical health information, the mental health surveys are only asked children of 8 or above years old. Therefore, after careful consideration and selection, our keep only 1,042 (in the year 2010) and 1,562 (in the year 2014) observations but with full information of children's, parents', and households' characteristics as well as parental migration status and children's health outcomes.

4.3.2 Health indicators

Liu et al. (2006) summarise that the existing literature examines children's health from three perspectives: clinical measures, such as child mortality, morbidity, and injury, anthropometric measures, such as weight, height and BMI, and self-rating scales for health evaluation. Zhao and Zhou (2018) also suggest that a comprehensive measure of children's health should involve three dimensions, physical health, mental health, and self-evaluated health. Thus, in this chapter we consider all these perspectives and dimensions to fully investigate the left-

13 The CFPS children's survey is designed to children up to 16 years old, and ones over 16 years' old answer the adult's survey. Here we modify the age of a "child" up to 18 years' old based on the relative definition from The United Nations Convention on the Rights of the Child, Constitutional Law of the People's Republic of China, Criminal law of the People's Republic of China, and Law of the People's Republic of China on the Protection of Minors.

behind children's health outcomes.

CFPS collects various indicators of children's physical health[14] and to avoid congenital diseases or hereditary disease, we emphasise on the children' stature and illness. Commonly, adults' stature is calculated from Body Mass Index (BMI, kg/m^2) and categorised as underweight (under 18.5), normal weight (18.5 to 25), overweight (25 to 30), or obese (over 30) based on WHO cut-off points. However, the observations in this chapter are children between age 8 to 17; therefore, we use a more accurate measurement from Center for Disease Control and Prevention (CDC) where calculated children and teens' BMI-for-age growth chart. Further to children's BMI, we also interested in the probability of a child being underweight or overweight, using the CDC growth chart as well. In their categories, the underweight children are in the range of less than the 5th percentile and overweight children are in the range of greater than the 85th percentile (the growth chart is presented in Appendix 4.1).

Children's illness is derived from the number of times that the child has been in the hospital because of the illness over the last 12 months initially asked in the survey. From the summarize statistics we find that the average times of a child go to the hospital in a year is 1.2 only, and the median is 0, so further we consider whether the child been to the hospital over the last 12 months as the probability of a child being ill.

14 All indicators are: height, weight, health self-assessment, physical discomfort, chronic illness, hospitalization experience, medical expenses, treatment of illness, satisfaction with medical conditions, Chinese medicine, physical exercise, diet, smoking and drinking experience, sleep, memory, primary care during illness, and human body function.

Children's mental health score in CFPS is collected from two psychological scales referring to the level of depression tendency. The first scale, Center for Epidemiologic Studies Depression Scale (CES-D), compiled by Radloff (1977), is one of the most widely used scales in the world for measuring depressive symptoms. It has been used in studies such as Health and Retirement Study (HRS, Institute for Social Research, University of Michigan), and National Longitudinal Survey of Mature and Young Women and Older and Young (NHAN, The Bureau of Labor Statistics, U.S.) In terms of the validity and reliability of using CES-D in China, Zhang et al. (2010) establish a norm of different ages across the country and conclude that CES-D is suitable for general population research as a primary screening tool in clinical applications in China.

The second scale is the Kessler Psychological Distress Scale (K6), a 6-item psychological screening instrument, developed by Kessler et al. (2002). K6 scale has been increasingly used in epidemiological studies, for instance, in two of the largest ongoing national health tracking surveys in the U.S. (CDC Behavioral Risk Factors Surveillance Survey and the SAMHSA National Household Survey); and it has also been modified to suit the China's case (Green et al., 2010). Given the access to measure children's mental health, one issue here is that CFPS does not use two scales in all three years (CES-D in the year 2012, K6 in the year 2010 and 2014). Thus, we use K6 questions as the benchmark and pick 6 the most similar questions in CES-D to stand for K6 in the year 2012, and then calculate the continuous mental health score (MHS) with a cut-off point of 8 suggesting the potential depression. (See Appendix 4.2 for full

questions of CES-D and K6 and mental health score calculation).

At last, CFPS asks children to evaluate their health status as self-reported health status (SRHS), which is a 5-scale from very unhealthy (1) to very healthy (5). It is an integrated variable that represents both respondent's physiological function and psychological status; therefore we use it to investigate children's general health and further generate a binary outcome that if children consider themselves healthy (scale 4) and very healthy (scale 5), the outcome equals to 1 as good, or the outcome is 0 if they report themselves as their health very unhealthy (1), unhealthy (2), and normal (3).

4.3.3 Descriptive statistics

In both 2010 and 2014 (Table 4.1.1 and 4.1.2), roughly 82% children (867 and 1,293 children for the year 2010 and 2014 respectively) had both parents as non-migrants, while 18% children (175 and 269 children for the year 2010 and 2014 respectively) had one or both parents as migrant. Amongst the migrant households, about 76% households (135 and 202 households for the year 2010 and 2014 respectively) had only one parent away, and of those parents 73% were fathers (114 and 145 in 2010 and 2014 respectively). We identify the location by using children's *hukou* type and find that roughly 80% children (852 and 1,211 children for the year 2010 and 2014 respectively) reside in rural areas. The ratio of either one or both parents migrant in rural areas is 20% (166 and 259 migrants for the year 2010 and 2014 respectively) whereas only 4% (9 and 10 migrants for the year 2010 and 2014 respectively) of parents

migrate if they originated from an urban area. Thus, in this chapter the migration effect is more emphasised on the rural-urban migration, but the urban-urban migration is also considered.

In terms of children's health outcomes, the difference in mean between non-migrants' and migrants' children have been presented in Table 4.2. The average BMI value of all children is around 17.8 suggesting a normal stature based on CDC children's growth chart. Non-migrant children have a higher BMI value in general than migrants' children, but the difference is not significant. Since we cannot tell whether a high or low BMI value is good, we turn the attention to children's underweight and overweight problem.

The percentage of underweight children (approx. 21%) is significantly higher than the percentage of overweight children (approx. 12%). Amongst the underweight children, the migrant households are more at risk of being underweight, while amongst the overweight children, there is no significant difference between the two groups. We can also confirm this by looking at the distribution of non-migrants' and migrants' BMI in Figure 4.2. Migrant children's BMI distribution for both years are right-skewed so that the mode is only 15. But the non-migrants' BMI follows the normal distribution and the mode is roughly 18. However, these differences are not statistically significant. In terms of the other physical health indicator, children's illness, we see that in 2010 migrants' children on average were hospitalised 0.55 more times than non-migrants' children.

On the contrary, the difference in children's mental health reveals a severe mental problem to

left-behind children. While the probability of feeling depression is 6% among the non-migrants' children, the same is 12% among the migrant children, and the difference is strongly significant. Finally, the child's self-reported health status indicates that most children believed themselves to be healthy (the scale 4). But there is a difference between non-migrants and migrant (although it is small in the order of approx. 0.1), and the difference is significant in the year of 2014, which suggests that migrants' children are not always as reassured as non-migrant children about their own health.

4.4 Model Specification

Since our primary interest is the parental migration effect on children's health from physical, mental and general health dimensions, we start with a simple OLS model to estimate the following equation,

$$H_i = \alpha_0 + \beta M_i + \boldsymbol{\theta}\mathbf{X}_i + \boldsymbol{\gamma}\mathbf{P}_i + \boldsymbol{\delta}\mathbf{F}_i + u_i \quad (4.1)$$

where the dependent variable H is the health outcome. Initially, we look at a general picture of whether children have any *health issue*, including both physical and mental problems. Specifically, children's physical health is firstly investigated by their stature – Body Mass Index (BMI), suggesting whether they are *underweight* or *overweight*. In addition, children's *illness* is also investigated by whether they have been to the hospital over the last year. Regarding children's mental health outcomes, it is derived from children's mental health score (MHS) and identify children's tendency of *depression* if they break the threshold of the score

8. Besides, children's *general health* is based on their self-reported health status (SRHS) whether they consider themselves as *healthy*. All outcomes equal to 1 if the answer is "yes", otherwise equal to 0.

The effect of parental migration is captured by the coefficient β on M which is an indicator equals to 1 if the one or both parents are migrants and 0 otherwise. The children's information, **X**, is a set of control variables including children's age, gender, *hukou* type, whether having the commercial insurance. The parental characteristics **P** includes the father's age, mother's age, father's educational level, and mother's educational level. The household characteristics **F** includes the family size and the distance to the closest hospital.

However, as discussed earlier, parents' migration decision is endogenous and their aspiration is unobserved; therefore, we use two instrument variables to fix the endogeneity and apply to a 2SLS estimation. The first-stage regression is followed as,

$$M_i = a_0 + \boldsymbol{b}\mathbf{Z}_i + \boldsymbol{c}\mathbf{W}_i + v_i \tag{4.2}$$

where **Z** is a pair of instrument variables, crude out-migration probability[15] (*CMP*) and the number of public transport vehicles for every 10,000 people (*transport*); both are at provincial

15 Van Imhoff (1991) suggests that the intensity of migration from the census data should represent a probability rather than a rate, thus, the crude migration probability is the simplest measure of population migration intensity. The probability is then subdivided into crude in-migration probability and crude out-migration probability. Formulas are as follows,

$$\text{Crude in-migration probability: } \mathrm{CM_iP_A} = \frac{\mathrm{M_i}}{\mathrm{P_A}}$$

$$\text{Crude out-migration probability: } \mathrm{CM_0P_A} = \frac{\mathrm{M_o}}{\mathrm{P_A}}$$

where $\mathrm{M_i}$ is the immigrate population; $\mathrm{M_o}$ is emigrate population; $\mathrm{P_A}$ is the total population of province A.

level and from the source location[16]. Other control variables (**W**) – children, parents, and households – remain the same.

Two IVs are picked by following the push-pull theory (Ravenstein, 1976) in migration studies and the most popular IV – historical migration rate (Hanson and Woodruff, 2003; Hildebrandt and McKenzie, 2005; McKenzie and Rapoport, 2011) and variables relating to economic conditions at destination locations using in the existing literature (Amuedo-Dorante et al., 2008; Amuedo-Dorantes and Pozo, 2010; Antman, 2011; Cortes, 2004; Yang, 2008). Both instruments are aggregative and beyond the influence of an individual household and have been tested econometrically that exogenous to children's health status.

The relevance of IVs is tested by checking the significance of $\boldsymbol{b}$ in the first-stage OLS estimation when migration decision is the dependent variable and two instruments along with all other controls are independent variables. Also, the robust F-statistics is checked to avoid weak instrument issue. We also use the robust Hausman test (Wooldridge, 1995) to confirm the endogeneity of the regressor and an overidentification test to confirm the exogeneity of two IVs (exclusion condition). We then obtain the fitted value $\widehat{M}_i$ from the first-stage regression and run the second-stage regression to produce $\hat{\beta}_{2\mathrm{SLS}}$.

Further, we estimate the effect in different scenarios when only the father migrates, only the mother migrates, both parents migrate, and three sub-sample estimates that differentiate the

16 All data are publicly released from National Bureau of Statistics, China, http://data.stats.gov.cn.

parental migration effects between boys and girls, young children and old children, and children reside in rural areas and urban areas. All other variables remain the same. Full variable description is presented in Table 4.1.1 and Table 4.1.2.

4.5 Estimation Results and Discussion

4.5.1 Non-IV estimates

Table 4.3 Non-IV estimates (extract)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
2010						
Migrants	0.003	0.040	-0.034	0.063	0.053**	0.024
	(0.036)	(0.038)	(0.025)	(0.041)	(0.026)	(0.015)
Observations	965	965	965	965	965	965
2014						
Migrants	0.008	0.030	0.013	-0.004	0.044*	-0.050
	(0.036)	(0.030)	(0.024)	(0.036)	(0.023)	(0.036)
Observations	1351	1351	1351	1351	1351	1351

See Table 4.3.1 and Table 4.3.2 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

Other control variables: children, parents, and households' characteristics.

* p < 0.1, ** p < 0.05, *** p < 0.01

We start with a simple OLS model to estimate the determinants of children's health outcomes. The results in Table 4.3 show that ideally parental migration does not lead to any significant health issues to children except for increasing the tendency of being (mentally) depressed by roughly 5% for both years. However, as parental migration decision can be correlated to some unobserved factors causing endogeneity in our model, we therefore turn to the instrument variable (IV) method to carry out further estimations.

4.5.2 IV estimates

To confirm the validity of our IVs, we present the first-stage regression results in Table 4.4. Data for two instruments in different years are chosen accordingly. We see that both IVs are strongly significant that people are more likely to migrate if the location has a high CMP, while they are discouraged to migrate if the location is well developed with sufficient infrastructures such as public transports. Also, our F-statistics are all greater than 10 ruling out the weak instruments issue.

Table 4.4 IV relevance condition (extract)

Migrants	(1)	(2)	(3)
2010			
CMP	0.022***	0.022***	0.021***
	(0.008)	(0.008)	(0.008)
Transport	-0.013**	-0.013***	-0.016***
	(0.005)	(0.005)	(0.005)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	1036	1031	965
Robust F	19.796	13.149	10.353
2014			
CMP	0.023***	0.022***	0.024***
	(0.007)	(0.007)	(0.007)
Transport	-0.014**	-0.014**	-0.014**
	(0.007)	(0.007)	(0.007)
Children's controls	YES	YES	YES
Parents' controls		YES	YES
Households' controls			YES
Observations	1551	1469	1351
Robust F	28.921	14.959	11.721

See Table 4.4.1 and Table 4.4.2 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

"YES" means the model includes that set of control variables.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 4.5 IV estimates (extract)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
2010						
Migrants	0.312**	0.254	-0.122	0.255	0.216**	-0.263***
	(0.135)	(0.181)	(0.517)	(0.217)	(0.087)	(0.016)
Observations	965	965	965	965	965	965
Robust Hausman	0.051	0.066	0.102	0.065	0.100	0.122
Sargan and Basmann	0.174	0.709	0.726	0.219	0.326	0.458
Father_Migrants	0.269	0.407***	-0.203	-0.305	0.084	-0.178
	(0.446)	(0.127)	(0.139)	(0.416)	(0.072)	(0.300)
Observations	910	910	910	910	910	910
Robust Hausman	0.082	0.058	0.062	0.104	0.093	0.108
Sargan and Basmann	0.157	0.790	0.761	0.320	0.602	0.476
Mother_Migrants	0.504*	0.685**	-0.187	0.276	0.594	0.781***
	(0.272)	(0.350)	(0.818)	(0.475)	(0.688)	(0.095)
Observations	824	824	824	824	824	824
Robust Hausman	0.056	0.045	0.068	0.057	0.102	0.138
Sargan and Basmann	0.636	0.910	0.958	0.410	0.318	0.613
Both_Migrants	0.226	0.053	-0.623	0.190	0.304***	-0.172**
	(0.284)	(0.239)	(0.443)	(0.345)	(0.055)	(0.080)
Observations	841	841	841	841	841	841
Robust Hausman	0.112	0.140	0.108	0.170	0.134	0.283
Sargan and Basmann	0.244	0.851	0.881	0.322	0.178	0.535
2014						
Migrants	0.453***	0.376***	-0.439**	0.386**	0.162	-0.511***
	(0.117)	(0.065)	(0.215)	(0.181)	(0.149)	(0.081)
Observations	1351	1351	1351	1351	1351	1351
Robust Hausman	0.021	0.001	0.017	0.070	0.142	0.046
Sargan and Basmann	0.912	0.824	0.139	0.154	0.387	0.647
Father_Migrants	0.575***	0.532***	-0.197	0.593***	0.346***	-0.636***
	(0.026)	(0.017)	(0.189)	(0.071)	(0.019)	(0.018)
Observations	1250	1250	1250	1250	1250	1250
Robust Hausman	0.052	0.001	0.055	0.045	0.021	0.081
Sargan and Basmann	0.266	0.241	0.122	0.815	0.202	0.536
Mother_Migrants	0.395	0.654***	-0.400***	0.370	0.135	-0.337
	(0.334)	(0.024)	(0.069)	(0.605)	(0.133)	(0.566)
Observations	1221	1221	1221	1221	1221	1221
Robust Hausman	0.113	0.014	0.003	0.113	0.072	0.210
Sargan and Basmann	0.532	0.290	0.604	0.361	0.962	0.189
Both_Migrants	0.232*	0.123**	-0.105**	0.214	0.091	-0.354*
	(0.157)	(0.068)	(0.035)	(0.369)	(0.101)	(0.182)
Observations	1179	1179	1179	1179	1179	1179
Robust Hausman	0.071	0.008	0.008	0.048	0.106	0.056
Sargan and Basmann	0.936	0.719	0.178	0.138	0.317	0.544

See Table 4.5.1 - 4.5.8 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

Other control variables: children, parents, and households' characteristics.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Now, we report parental migration effects on children's health in Table 4.5. We start with an overview of the migration effect without distinguishing the migrating family members or the number of migrants. We find that once the migration variable is instrumented, it indeed causes more health issues to left behind children; however, the effects are divergent in terms of the health outcomes and years. In the year 2010, the (left behind) migrant children have 21.6% higher probability of being mentally depressed than the non-migrant children. In the year 2014, the migrant children suffer a greater likelihood of being underweight and sick than the non-migrant children. Their self-reported health status is consistently suggesting poor general health in both years, as it represents an overall health evaluation. This fact is also proved by comparing our objective outcome – health issue – that though the report is subjective, the poor health matches to some existing health issues. Thus, the results confirm our three main hypotheses ($H_1, H_2,$ and H_3) regarding the effect of parental migration on children's health outcomes.

We then want to nail down the migration effects by considering two questions: who migrates, and how many members of the households migrate? In the year 2010, we see that a migrant child is very likely to be underweight if his/her father or mother (but not both) has migrated, but he/she is mentally well; however, the outcome is reversed when both parents have migrated. The child then experiences mental issues, such as a high tendency of depression, but he/she remains physically well. A possible reason for good physical health can be greater remittance resulting from both parents migrating. In the year 2014, two scenarios also indicate different effects, but different to 2010. When the father migrates alone, it leads to the worst impact to

the child that he/she is physically weaker and has more mental issues relative to non-migrants' child. Our hypotheses H_4 is verified. Thus, all results can be summarised so far as parental migration negatively affects children's physical and mental health.

Table 4.6 Correlation between parental migration and children's diet

2010 \ 2014	Migrants	Exercise	Meat	Fish	VegFrt	Milk	Egg	Pickled	Fried
Migrants	1	-0.077***	-0.103***	-0.103***	-0.012	-0.076***	-0.045*	-0.068***	-0.079***
Exercise	0.022	1	-0.015	0.035	0.061**	0.061**	-0.011	-0.001	0.012
Meat	-0.056*	0.000	1	0.270***	0.098***	0.102***	0.147***	0.125***	0.115***
Fish	-0.070**	0.012	0.309***	1	0.111***	0.203***	0.176***	0.263***	0.108***
VegFrt	-0.015	0.095***	0.085***	0.143***	1	0.077***	0.116***	0.056**	0.048*
Milk	-0.040	0.167***	0.206***	0.266***	0.140***	1	0.169***	0.189***	0.240***
Egg	0.044	0.078**	0.245***	0.237***	0.185***	0.221***	1	0.162***	0.103***
Pickled	-0.010	0.059*	0.132***	0.201***	0.106***	0.197***	0.235***	1	0.242***
Fried	-0.012	0.120***	0.134***	0.162***	0.134***	0.276***	0.210***	0.320***	1

* p < 0.1, ** p < 0.05, *** p < 0.01

To reveal the causal effects of parental migration, we check some correlations. Firstly, in Table 4.6, left-behind children's diet is poor and they have fewer opportunities to intake nutritious food than the non-migrants' children; this is more significant in the year 2014. Though migrants send remittance back, the original household is poor so that the money is either saved for covering pre-migration cost or invested in the physical assets instead of the child health. Since the mother is the primary caregiver in most families, her migration shows stronger negative effects on the child. While both parents migrate, the left-behind child stays with extended family members who are reliable and responsible – usually the grandparents – is the least affected compared to other situations. For children's illness, we see an unclear effect between the year 2010 and the year 2014, possibly because children's illness is defined as

whether the child has been to the hospital over the last 12 months and up to the household's willingness of spending money on non-urgent illness.

In terms of children's mental health, all significant results suggest a negative effect of parental migration. However, the mother's migration shows no significant effect. This is because of modern technological that helps most mothers keep daily contacts with their children. But when the father migrates (and most migrants in our sample are father), the child may miss father's support and supervision. It is also likely that fathers may work longer hours, which does not allow them to maintain daily or frequent contacts with the family. However, our data do not allow us to investigate the issue further. We also see that if migrating parents increase the number of visits with their child (Figure 4.3), it alleviates children's mental problems; but whether such action literally solves the existing depression problem remains unclear.

Table 4.7 Correlation among children's health outcomes

2010 \ 2014	Underweight	Overweight	Illness	Depression	General health
Underweight	1	-0.196***	0.008	0.006	-0.067***
Overweight	-0.186***	1	0.028	0.012	0.007
Illness	-0.033	-0.057*	1	-0.049*	-0.061**
Depression	-0.011	0.064**	-0.029	1	-0.052**
General health	-0.044	-0.064**	0.006	-0.035	1

* p < 0.1, ** p < 0.05, *** p < 0.01

From the mental health literature, we know that children's self-reported health status reflects both their physical and mental health. So, here we check the correlation among all health indicators and see if they are indeed related (Table 4.7). The result confirms that children indicate their overall health based on both physical and mental results; they concern more to

their stature and appearance as most young people do rather than the illness. One other thing has drawn our attention from the correlation table – children's illness has a significant negative correlation with the depression, suggesting that even the child is not ill, he/she might be depressed even the illness has shown no correlation with children's underweight or overweight problem. As we explained, the illness is only the evidence that the child has been in the hospital; while children in families who cannot afford hospital expense or have not noticed children's abnormal, children worry themselves and stress out that also lead to mental problems.

4.5.3 Sub-sample estimates

Now we report the results from the sub-sample estimations where children have been grouped by age, gender, and location to verify our last hypothesis H_5 (Table 4.8 and Table 4.9). The migration effects are no longer distinguished by the role or the number of migrants in a household. We find that young children (8-12) are significantly suffering parents' migration that hurting their emotions therefore showing a high probability of being depressed, while old children (13-17) can understand and support their parents' decision. In the year 2010, we see a significant difference in children's physical health between two age groups that old children are more likely to be underweight but less likely to be ill. Old children grow faster and require more food not only the amount but and quality; besides, they are more self-awareness so that would speak out if they are sick and need to go hospital, while the young children would not.

Table 4.8 Sub-sample IV estimates: children's characteristics (extract, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
2010	Health issue	Underweight	Overweight	Illness	Depression	General health
8-12 years old						
Migrants	0.258*	0.162	-0.266	0.510***	0.329***	-0.159
	(0.141)	(0.324)	(0.266)	(0.139)	(0.024)	(0.183)
Observations	436	436	436	436	436	436
Robust Hausman	0.051	0.233	0.147	0.041	0.127	0.078
Sargan and Basmann	0.363	0.662	0.421	0.450	0.463	0.318
13-17 years old						
Migrants	0.155***	0.378***	-0.333	-0.463***	0.071	0.194
	(0.008)	(0.139)	(0.264)	(0.121)	(0.056)	(0.247)
Observations	529	529	529	529	529	529
Robust Hausman	0.062	0.047	0.082	0.075	0.203	0. 251
Sargan and Basmann	0.316	0.895	0.822	0.828	0.943	0.755
Boys						
Migrants	0.222	0.267**	-0.385	0.382	0.014	0.144
	(0.304)	(0.134)	(0.253)	(0.361)	(0.116)	(0.156)
Observations	479	479	479	479	479	479
Robust Hausman	0.039	0.051	0.140	0.150	0.094	0.274
Sargan and Basmann	0.187	0.493	0.861	0.456	0.885	0.420
Girls						
Migrants	0.403***	0.122	-0.265	0.232	0.405*	-0.285***
	(0.095)	(0.637)	(0.485)	(0.227)	(0.301)	(0.022)
Observations	486	486	486	486	486	486
Robust Hausman	0.052	0.094	0.155	0.230	0.064	0.014
Sargan and Basmann	0.688	0.901	0.606	0.355	0.894	0.785
Urban						
Migrants	-0.581***	0.378	-0.208**	-0.495***	-0.053	0.064
	(0.059)	(0.417)	(0.086)	(0.086)	(0.113)	(1.085)
Observations	180	180	180	180	180	180
Robust Hausman	0.084	0.165	0.184	0.220	0.308	0.198
Sargan and Basmann	0.989	0.745	0.847	0.975	0.972	0.987
Rural						
Migrants	0.392***	0.395***	-0.251	0.460***	0.307**	-0.273***
	(0.068)	(0.121)	(0.217)	(0.128)	(0.155)	(0.021)
Observations	785	785	785	785	785	785
Robust Hausman	0.005	0.056	0.210	0.046	0.088	0.152
Sargan and Basmann	0.211	0.656	0.864	0.153	0.158	0.458

See Table 4.8.1 – 4.8.6 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

Other control variables: children, parents, and households' characteristics.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 4.9 Sub-sample IV estimates: children's characteristics (extract, 2014)

	(1)	(2)	(3)	(4)	(5)	(6)
2014	Health issue	Underweight	Overweight	Illness	Depression	General health
8-12 years old						
Migrants	0.347	0.309**	-0.260*	0.462***	0.425*	0.112
	(0.238)	(0.141)	(0.153)	(0.119)	(0.248)	(0.378)
Observations	694	694	694	694	694	694
Robust Hausman	0.112	0.045	0.023	0.076	0.125	0.098
Sargan and Basmann	0.842	0.992	0.322	0.065	0.334	0.443
13-17 years old						
Migrants	0.539***	0.400***	-0.058	0.526***	0.091	-0.522***
	(0.024)	(0.086)	(0.147)	(0.083)	(0.260)	(0.081)
Observations	657	657	657	657	657	657
Robust Hausman	0.027	0.010	0.073	0.090	0.189	0.000
Sargan and Basmann	0.813	0.945	0.261	0.792	0.700	0.917
Boys						
Migrants	0.206	0.388***	-0.441***	0.170	0.148*	-0.559**
	(0.285)	(0.084)	(0.032)	(0.369)	(0.078)	(0.225)
Observations	707	707	707	707	707	707
Robust Hausman	0.248	0.038	0.007	0.262	0.194	0.224
Sargan and Basmann	0.948	0.505	0.687	0.646	0.244	0.457
Girls						
Migrants	0.495***	0.306**	0.167**	0.525***	0.140	-0.539***
	(0.023)	(0.134)	(0.075)	(0.039)	(0.254)	(0.064)
Observations	644	644	644	644	644	644
Robust Hausman	0.023	0.054	0.046	0.086	0.099	0.055
Sargan and Basmann	0.572	0.445	0.530	0.193	0.937	0.803
Urban						
Migrants	0.404***	-0.145	-0.451	0.624***	-0.184***	0.015***
	(0.090)	(0.192)	(0.080)	(5.209)	(0.069)	(0.001)
Observations	318	318	318	318	318	318
Robust Hausman	0.324	0.083	0.056	0.135	0.485	0.101
Sargan and Basmann	0.539	0.620	0.850	0.296	0.968	0.451
Rural						
Migrants	0.510***	0.354***	-0.169	0.482***	0.272**	-0.368
	(0.016)	(0.095)	(0.179)	(0.113)	(0.132)	(0.291)
Observations	1033	1033	1033	1033	1033	1033
Robust Hausman	0.009	0.010	0.065	0.133	0.103	0.209
Sargan and Basmann	0.770	0.843	0.184	0.332	0.317	0.930

See Table 4.9.1 – 4.9.6 for full regression results.

The heteroscedasticity-robust standard error is reported in the brackets.

Other control variables: children, parents, and households' characteristics.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* p < 0.1, ** p < 0.05, *** p < 0.01

The migration effects on boys and girls show significant differences between two years. In the year 2010, girls have significantly more health issues especially in mental health aspect, and so as their self-reported health status; while boys only appear to be underweight. In the year 2014, it is the boys who are showing more mental health problem and the girls are showing more physical health issues. Although the current Chinese preference for sons is not as significant as the last century, when the left-behind child is a girl, she is usually asked to undertake more domestic work or even being in the role of a mother if there are any younger siblings in the household, and therefore she is easy to be sick and stressed out. Thus, considering both years, it becomes evidential that girls are negatively affected thoroughly.

At last, we see very different results shown between rural and urban left-behind children, especially in the year 2010. When children are left behind in urban areas, they become healthier showing fewer issues or more likely to report themselves as healthy than non-migrants whereas children left behind in rural areas tend to have a variety of health issues. These are attributed to that urban areas have well established social care system to left-behind children through multiple channels such as schools and communities so that they have a very positive attitude. However, migration does cost money especially when the living cost is high at the same time in urban areas, thus migrants' households still face the fact of a shortage of money so they need to save the money in case for needs rather than spend on a large amount of quality food. In our data, we see that most left-behind children are from rural areas, therefore the results are consistent to the full sample estimation. Thus, for the rural left-behind children,

they have an overall poor health outcome because of the lack of nutritious food, emotional support, and parental care.

Regarding other control variables, parents' age indirectly suggests their health as the elderly faces to more health issues themselves so that they are distracted and to some extended unable to provide quality-parenting, therefore, they show negative effects on children's underweight, depression, and general health, whereas young mothers have opposite characteristics and show positive effects. A high level of education allows parents to live in a healthy life and deal with diseases, however, when parents are away, the child becomes vulnerable to illness and has a higher probability of being overweight. Household characteristics show significant and positive effects if there are more care-givers in the household, or the surrounding of the family has well established facilities.

4.6 Conclusion

It is a worldwide phenomenon that parents migrate but left the children behind. With the massive absolute numbers of children affected in China, the consequence of their health has drawn the public's interest and concern. Once the left-behind children lost the care from their parents or at least one parent as well as a cosy family environment, their health is exposed to various adverse conditions, for instance, being more vulnerable to illness or injury because of inadequate nutrient intake and lack of parental protection. Moreover, a reduced quality of

parenting caused by migration negatively influence children's and youth's mental health, which can lead to irreversible consequences. According to the National Health Service in England, 75% of the adult experiencing mental problems before the age of 18. Failure to support the youth will pay the heavy price on money and even their lives. The early intervention will effectively avoid the youth falling into crisis and the long-term suffering in their adulthood.

Therefore, in this chapter, we fully investigate the effect of parental migration on left-behind children's health and aim to figure out whether children's stature is affected and face to more illness and how their mental health is and how they consider themselves' health status. We use two cross-sectional data from China Family Panel Studies (CFPS) where the individual and household are observed at the source location. The empirical strategy is to use instrument variables as the decision that parents made to migrate is correlated to some omitted variables so that become endogenous, and then using 2SLS to carry out the estimations. Several findings are concluded below.

In the first-stage estimation, we find that parents' migration decision has been significantly affected by the macroeconomic environment at source locations following the "push-pull" theory in migration studies. In the IV estimations, the left-behind children's health has been affected in all dimensions. Though migration may improve the wealth level, the original household is still relatively poor so that the money is either saved for covering pre-migration cost or invest in the physical assets rather than invest in children's health, and thus results in a

poor diet of the left-behind children and untimely medical care. Results from children's mental health and self-reported health are consistent with existing literature suggesting that children are sorely lacking contacts and caring from the migrating parents that easily become upset, not confident, feel difficulties in life, and rather consider themselves less healthy than others. Though strengthening the contact between migrating parents and the left-behind children can alleviate children's existing mental problems, it cannot literally get rid of them. Regarding a specific migrating member or number of migrants, we find that migrating mothers often leave children to a more vulnerary environment as she is primary caregiver in the family while migrating fathers are lack of emotional bonds to children. When both parents migrate and left-behind children have been well taken care of by extended family members so that they are the least suffered among others.

In order to specify the parental migration effects on different groups of children, we carry out three sub-sample estimations comparing between young and old children, boys and girls, and rural and urban children. We find that young children are emotional hurting by an early separation with parents and even be discriminated by their non-migrants' peers; old children are understanding and mature but they are facing underweight problems in response to their growth so that they require more nutrient intake but restricted by household wealth. Left-behind girls are expected to take more housework and play parents' role so that they show a significantly higher likelihood of being physically weaker and under much more stress comparing to left-behind boys. When children are left behind at urban areas, they benefit from a well-established social care system and high-quality schooling education, they are more

favourable than children left-behind at rural areas without external protection, plus it is the rural areas that are facing the severe malnutrition and poor surroundings.

However, due to the data limitation, some other effects that derived from parental migration are not well captured in this chapter. For instance, different rounds of CFPS collections interview slightly different types of questions and select different households so that it is hard to merge into a balanced panel format without losing significant observations. In addition, children's diet information from the qualitative perspective (frequency), not the quantitative perspective (precise amount) that we can only combine with the household wealth to make assumptions. At last, we indeed observe part of family contacts through the frequency of parents and children visiting each other, however, there may also have endogeneity issue that some unobserved factors are correlated to the frequency such as the distance of migration. We shall work on these in our further research.

Figure 4.1 CFPS source areas in China

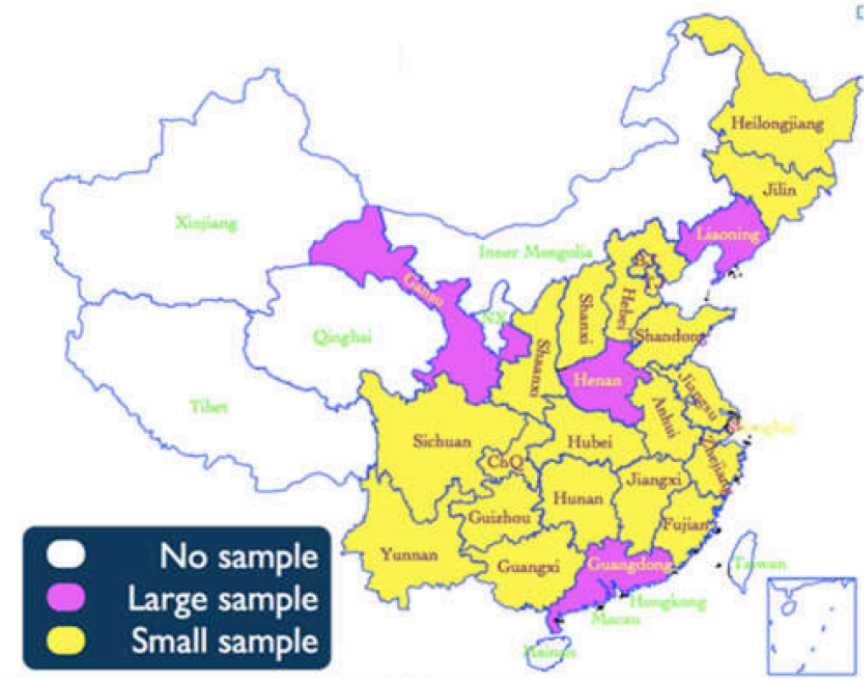

Figure 4.2 Distribution of children's BMI

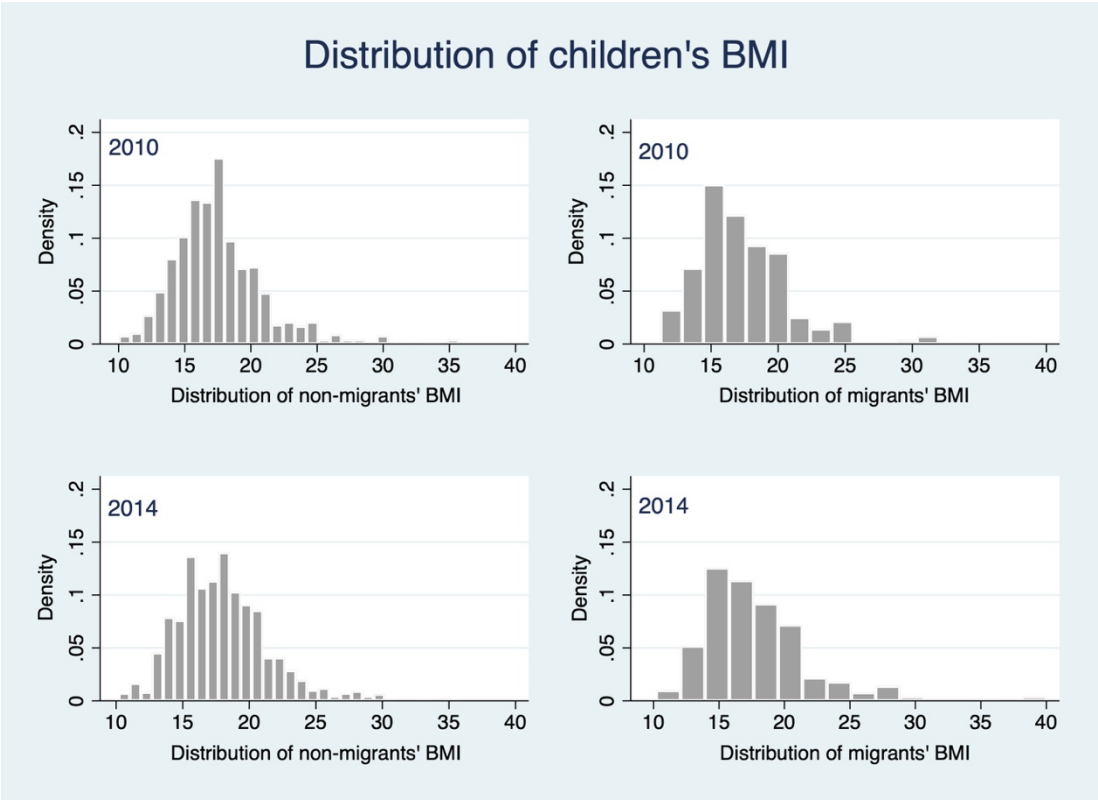

Figure 4.3 Mental health of left-behind children and contacts with migrating parents

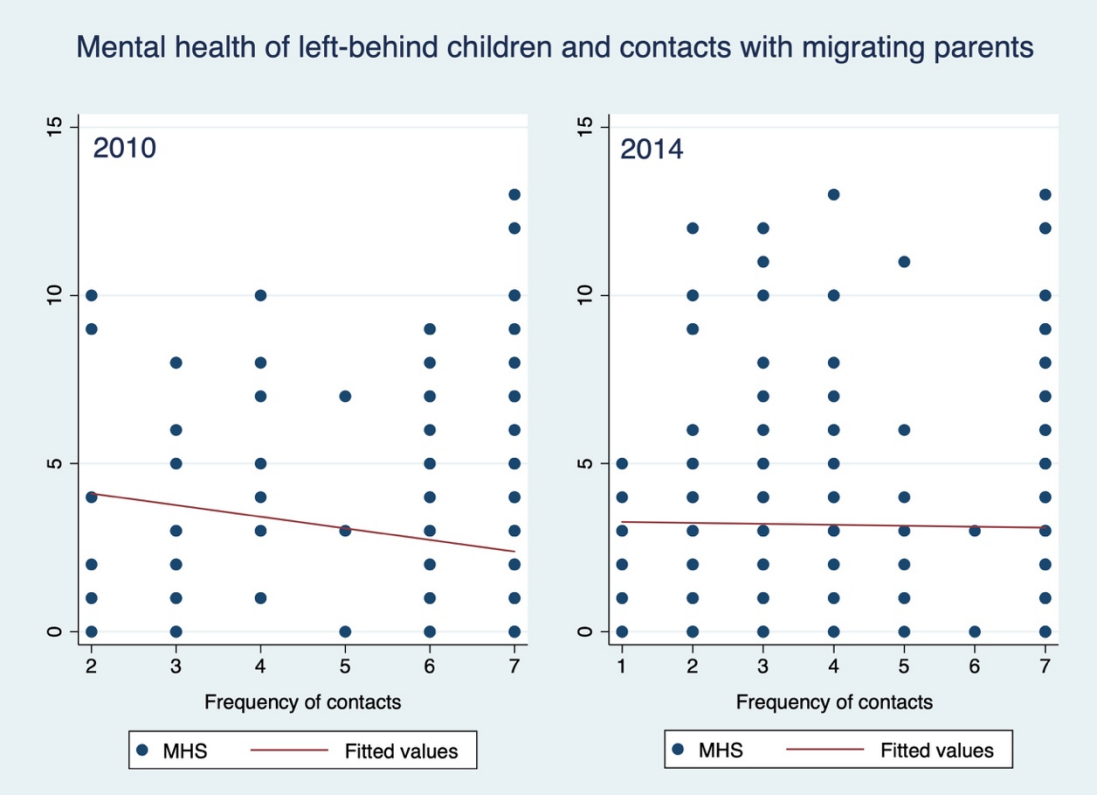

Table 4.1.1 Descriptive Statistics (2010)

VarName	Description	Obs	Mean	SD	Min	Median	Max
Migrants	Parental migration status (dummy, migrant=1, non-migrant=0).	1042	0.168	0.374	0	0	1
Fa_Migrants	Father's migration status (dummy, migrant = 1, non-migrant = 0).	981	0.116	0.321	0	0	1
Mo_Migrants	Mother's migration status (dummy, migrant = 1, non-migrant = 0).	888	0.024	0.152	0	0	1
Both_Migrants	Both father and mother are migrants (dummy, migrant = 1, non-migrant = 0)	907	0.044	0.205	0	0	1
CMP	Provincial crude out-migration probability at the source location (2001-2005).	1042	2.731	1.496	.98	1.98	6.41
Transport	Provincial number of public transport vehicles (standard) for every 10,000 people at the source location in 2005.	1042	7.530	1.878	5.73	7.09	22.19
Health issue	Any health issues that the child has, including underweight, overweight, illness, depression (dummy, yes=1, no=0)	1042	0.775	0.417	0	1	1
BMI	Children's Body Mass Index (BMI, kg/m^2).	1042	17.570	3.525	10.039	17.146	35.714
Underweight	Children's BMI value is lower than the 5th percentile in CDC children and teens' BMI-for-age growth chart (dummy, yes=1, no=0)	1042	0.231	0.422	0	0	1
Overweight	Children's BMI value is greater than the 85th percentile in CDC children and teens' BMI-for-age growth chart (dummy, yes=1, no=0)	1042	0.103	0.304	0	0	1
Illness_no.	Times of children went to hospital over last 12 months because of the illness	643	1.101	2.195	0	0	20
Illness	whether the children went to hospital over last 12 months because of the illness (dummy, yes = 1, no = 0)	1042	0.614	0.487	0	1	1
MHS	Children's mental health score, calculated from CES-D and K6 psychological surveys.	1042	2.309	2.684	0	1	14
Depression	The tendency of depression, if children's MHS >= 8, depression = 1; if MHS < 8, depression = 0.	1042	0.059	0.235	0	0	1
SRHS	Child Self-reported Health Status, very unhealthy = 1, unhealthy = 2, normal = 3, healthy = 4, very healthy = 5.	1042	4.637	0.646	1	5	5
General health	Children general health (dummy, healthy & very healthy = 1, unhealthy & unhealthy & normal = 0)	1042	0.962	0.192	0	1	1
Age	Children's age, between 8 to 17.	1042	12.687	1.695	10	13	15
Gender	Children's gender, boys = 1, girls = 0.	1042	0.492	0.500	0	0	1
Hukou	Children's hukou type (dummy, urban = 1, rural = 0).	1042	0.182	0.386	0	0	1
Insurance	Children's commercial insurance (dummy, yes = 1, no = 0)	1036	0.190	0.393	0	0	1
Fa_Age	Father's age.	1041	40.500	5.346	28	40	75
Mo_Age	Mother's age	1038	38.853	4.843	23	38	72
Fa_Edu	Father's educational level	1042	2.385	0.965	1	2.333	6
Fa_Lowedu	whether the father obtained junior high school education level, yes = 1, else = 0.	1042	0.238	0.426	0	0	1
Fa_Midedu	whether the father obtained senior high school education level, yes = 1, else = 0.	1042	0.080	0.271	0	0	1
Fa_Highedu	whether the father obtained higher education level, yes = 1, else = 0.	1042	0.021	0.144	0	0	1
Mo_Edu	Father's educational level	1042	1.987	0.950	1	2	6
Mo_Lowedu	whether the mother obtained junior high school education level, yes = 1, else = 0.	1042	0.164	0.371	0	0	1
Mo_Midedu	whether the mother obtained senior high school education level, yes = 1, else = 0.	1042	0.042	0.201	0	0	1
Mo_Highedu	whether the mother obtained higher education level, yes = 1, else = 0.	1042	0.010	0.098	0	0	1
Family size	Number of family members	1020	4.123	1.653	1	4	13
Hospital distance	Distance to the closest hospital (km)	995	1.681	3.269	.001	.6	40

Table 4.1.2 Descriptive Statistics (2014)

VarName	Description	Obs	Mean	SD	Min	Median	Max
Migrants	Parental migration status (dummy, migrant=1, non-migrant=0).	1562	0.172	0.378	0	0	1
Fa_Migrants	Father's migration status (dummy, migrant = 1, non-migrant = 0).	1438	0.101	0.301	0	0	1
Mo_Migrants	Mother's migration status (dummy, migrant = 1, non-migrant = 0).	1350	0.042	0.201	0	0	1
Both_Migrants	Both father and mother are migrants (dummy, migrant = 1, non-migrant = 0)	1360	0.049	0.216	0	0	1
CMP	Provincial crude out-migration probability at the source location (2006-2010).	1562	4.123	2.055	1.62	3.83	9.04
Transport	Provincial number of public transport vehicles (standard) for every 10,000 people at the source location in 2010.	1562	8.953	1.232	6.83	9.35	14.24
Health issue	Any health issues that the child has, including underweight, overweight, illness, depression (dummy, yes=1, no=0)	1562	0.632	0.482	0	1	1
BMI	Children's Body Mass Index (BMI, kg/m^2).	1562	18.040	3.690	10.204	17.604	40
Underweight	Children's BMI value is lower than the 5th percentile in CDC children and teens' BMI-for-age growth chart (dummy, yes=1, no=0)	1562	0.197	0.398	0	0	1
Overweight	Children's BMI value is greater than the 85th percentile in CDC children and teens' BMI-for-age growth chart (dummy, yes=1, no=0)	1562	0.136	0.343	0	0	1
Illness_no.	Times of children went to hospital over last 12 months because of the illness	1534	1.271	2.438	0	0	24
Illness	whether the children went to hospital over last 12 months because of the illness (dummy, yes = 1, no = 0)	1562	0.404	0.491	0	0	1
MHS	Children's mental health score, calculated from CES-D and K6 psychological surveys.	1562	2.845	2.910	0	2	15
Depression	The tendency of depression, if children's MHS >= 8, depression = 1; if MHS < 8, depression = 0.	1562	0.081	0.273	0	0	1
SRHS	Child Self-reported Health Status, very unhealthy = 1, unhealthy = 2, normal = 3, healthy = 4, very healthy = 5.	1562	3.854	0.977	1	4	5
General health	Children general health (dummy, healthy & very healthy = 1, unhealthy & unhealthy & normal = 0)	1562	0.643	0.479	0	1	1
Age	Children's age, between 8 to 17.	1562	12.500	1.747	8	12	17
Gender	Children's gender, boys = 1, girls = 0.	1562	0.521	0.500	0	1	1
Hukou	Children's hukou type (dummy, urban = 1, rural = 0).	1562	0.225	0.418	0	0	1
Insurance	Children's commercial insurance (dummy, yes = 1, no = 0)	1551	0.177	0.382	0	0	1
Fa_Age	Father's age.	1562	41.117	5.054	29	41	67
Mo_Age	Mother's age	1561	39.308	5.051	25	39	76
Fa_Edu	Father's educational level	1488	2.484	1.212	1	2	8
Fa_Lowedu	whether the father obtained junior high school education level, yes = 1, else = 0.	1488	0.317	0.465	0	0	1
Fa_Midedu	whether the father obtained senior high school education level, yes = 1, else = 0.	1488	0.087	0.281	0	0	1
Fa_Highedu	whether the father obtained higher education level, yes = 1, else = 0.	1488	0.069	0.254	0	0	1
Mo_Edu	Father's educational level	1554	2.737	1.187	1	3	7
Mo_Lowedu	whether the mother obtained junior high school education level, yes = 1, else = 0.	1554	0.360	0.480	0	0	1
Mo_Midedu	whether the mother obtained senior high school education level, yes = 1, else = 0.	1554	0.124	0.329	0	0	1
Mo_Highedu	whether the mother obtained higher education level, yes = 1, else = 0.	1554	0.081	0.273	0	0	1
Family size	Number of family members	1489	4.226	1.993	1	4	17
Hospital distance	Distance to the closest hospital (km)	1504	1.453	2.728	.001	.5	50

Table 4.2 Difference in mean: non-migrants vs. migrants (t-test)

	2010			2014		
VarName	Non-migrants (0)	Migrants (1)	Diff. (0-1)	Non-migrants (0)	Migrants (1)	Diff. (0-1)
Health issue	0.634	0.648	-0.015	0.629	0.605	0.025
BMI	17.377	17.037	0.340	18.070	17.892	0.178
Underweight	0.239	0.287	-0.048	0.191	0.228	-0.037
Overweight	0.127	0.120	0.007	0.137	0.137	0.000
Illness_no.	1.009	1.556	-0.546**	1.291	1.175	0.116
Illness	0.363	0.435	-0.073	0.402	0.350	0.052
MHS	2.222	2.852	-0.629**	2.793	3.160	-0.367*
Depression	0.052	0.111	-0.059**	0.074	0.125	-0.052***
SRHS	4.585	4.648	-0.063	3.879	3.738	0.141**
General health	0.953	0.963	-0.010	0.652	0.597	0.055*

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.3.1 Non-IV estimation (OLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.003	0.040	-0.034	0.063	0.053**	0.024
	(0.036)	(0.038)	(0.025)	(0.041)	(0.026)	(0.015)
Gender	0.079***	0.010	0.050**	0.061**	-0.021	0.012
	(0.027)	(0.028)	(0.020)	(0.030)	(0.015)	(0.013)
Age	0.036***	0.000	-0.038***	0.080***	-0.002	0.005
	(0.008)	(0.008)	(0.006)	(0.009)	(0.005)	(0.004)
Hukou	-0.017	-0.010	-0.001	0.002	0.003	0.004
	(0.038)	(0.038)	(0.029)	(0.044)	(0.022)	(0.017)
Insurance	0.063*	0.001	0.004	0.106***	0.020	-0.032*
	(0.032)	(0.034)	(0.026)	(0.037)	(0.021)	(0.018)
Parents characteristics						
Fa_Age	0.014***	0.014***	0.002	0.013***	0.004	0.002
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)
Mo_Age	-0.012***	-0.018***	-0.001	-0.010**	-0.003	-0.001
	(0.004)	(0.005)	(0.003)	(0.005)	(0.003)	(0.002)
Fa_Midedu	-0.113*	-0.014	-0.056*	-0.082	-0.040*	0.047***
	(0.059)	(0.052)	(0.030)	(0.062)	(0.021)	(0.011)
Fa_Highedu	0.137	-0.066	0.062	0.145	-0.000	-0.014
	(0.101)	(0.075)	(0.092)	(0.114)	(0.060)	(0.058)
Mo_Midedu	-0.224***	-0.065	-0.060	-0.213***	0.016	-0.021
	(0.080)	(0.059)	(0.043)	(0.079)	(0.042)	(0.033)
Mo_Highedu	-0.396***	-0.048	-0.144**	-0.247*	-0.057	0.055
	(0.146)	(0.110)	(0.069)	(0.137)	(0.044)	(0.043)
Household characteristics						
Family size	0.006	0.001	0.006	0.003	-0.000	-0.002
	(0.008)	(0.008)	(0.007)	(0.009)	(0.005)	(0.004)
Hospital distance	-0.006	-0.003	0.003	-0.002	-0.002	-0.004
	(0.004)	(0.004)	(0.003)	(0.004)	(0.002)	(0.002)
Constant	0.181	0.373***	0.505***	-0.605***	0.006	0.863***
	(0.132)	(0.134)	(0.114)	(0.149)	(0.089)	(0.061)
Observations	965	965	965	965	965	965
Prob>F	0.000	0.079	0.000	0.000	0.002	0.003
R-squared	0.066	0.008	0.044	0.107	0.003	0.005

The heteroscedasticity-robust standard error is reported in the brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.3.2 Non-IV estimation (OLS, 2014)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.008	0.030	0.013	-0.004	0.044*	-0.050
	(0.036)	(0.030)	(0.024)	(0.036)	(0.023)	(0.036)
Gender	0.076***	-0.002	0.104***	0.046*	0.001	0.001
	(0.026)	(0.022)	(0.018)	(0.027)	(0.015)	(0.026)
Age	-0.034***	-0.009	-0.028***	-0.024***	-0.007	0.002
	(0.008)	(0.006)	(0.005)	(0.008)	(0.005)	(0.008)
Hukou	0.111***	0.020	0.035	0.134***	0.002	0.044
	(0.036)	(0.031)	(0.028)	(0.038)	(0.020)	(0.037)
Insurance	0.041	-0.034	0.006	0.053	0.028	-0.029
	(0.034)	(0.027)	(0.025)	(0.036)	(0.021)	(0.035)
Parents characteristics						
Fa_Age	0.002	0.003	0.001	-0.001	0.002	-0.009**
	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Mo_Age	-0.006	-0.003	-0.004	0.001	-0.004*	0.006
	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Fa_Midedu	0.010	-0.071**	0.034	-0.004	-0.010	0.020
	(0.050)	(0.035)	(0.036)	(0.052)	(0.026)	(0.050)
Fa_Highedu	0.022	-0.139***	0.080*	0.098	0.004	-0.109*
	(0.063)	(0.042)	(0.047)	(0.065)	(0.034)	(0.064)
Mo_Midedu	-0.026	-0.021	-0.032	0.020	-0.043**	-0.027
	(0.043)	(0.034)	(0.030)	(0.043)	(0.019)	(0.043)
Mo_Highedu	-0.042	0.021	0.009	-0.068	-0.045	0.094*
	(0.059)	(0.046)	(0.041)	(0.059)	(0.029)	(0.056)
Household characteristics						
Family size	-0.006	-0.006	-0.006	-0.005	0.002	0.014**
	(0.006)	(0.005)	(0.004)	(0.007)	(0.004)	(0.006)
Hospital distance	0.006	0.001	-0.005	0.009*	0.003	-0.006
	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)
Constant	1.135***	0.330***	0.569***	0.654***	0.248***	0.677***
	(0.132)	(0.112)	(0.098)	(0.133)	(0.082)	(0.135)
Observations	1351	1351	1351	1351	1351	1351
Prob>F	0.000	0.007	0.000	0.000	0.024	0.045
R-squared	0.029	0.004	0.056	0.023	0.010	0.006

The heteroscedasticity-robust standard error is reported in the brackets.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 4.4.1 IV relevance condition (OLS, 2010)

	(1)	(2)	(3)
CMP	0.022***	0.022***	0.021***
	(0.008)	(0.008)	(0.008)
Transport	-0.013**	-0.013***	-0.016***
	(0.005)	(0.005)	(0.005)
Gender	-0.034	-0.031	-0.037
	(0.023)	(0.023)	(0.023)
Age	-0.003	-0.000	-0.005
	(0.007)	(0.007)	(0.007)
Hukou	-0.137***	-0.129***	-0.125***
	(0.022)	(0.024)	(0.025)
Insurance	0.043	0.050	0.044
	(0.030)	(0.031)	(0.030)
Parents characteristics			
Fa_Age		-0.005	-0.004
		(0.004)	(0.004)
Mo_Age		0.001	-0.001
		(0.004)	(0.004)
Fa_Midedu		-0.044	-0.065*
		(0.039)	(0.037)
Fa_Highedu		-0.005	-0.031
		(0.078)	(0.087)
Mo_Midedu		0.041	0.072
		(0.058)	(0.060)
Mo_Highedu		-0.056	-0.020
		(0.057)	(0.066)
Household characteristics			
Family size			0.047***
			(0.008)
Hospital distance			-0.003
			(0.004)
Constant	0.283***	0.421***	0.349***
	(0.106)	(0.132)	(0.135)
Observations	1036	1031	965
Robust F	19.796	13.149	10.353
R-squared	0.039	0.045	0.092

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 4.4.2 IV relevance condition (OLS, 2014)

	(1)	(2)	(3)
CMP	0.023***	0.022***	0.024***
	(0.007)	(0.007)	(0.007)
Transport	-0.014**	-0.014**	-0.014**
	(0.007)	(0.007)	(0.007)
Gender	-0.008	-0.009	-0.018
	(0.019)	(0.019)	(0.020)
Age	-0.008	-0.003	-0.004
	(0.005)	(0.006)	(0.006)
Hukou	-0.177***	-0.155***	-0.165***
	(0.015)	(0.020)	(0.022)
Insurance	-0.025	-0.024	-0.028
	(0.023)	(0.023)	(0.024)
Parents characteristics			
Fa_Age		0.001	0.002
		(0.003)	(0.003)
Mo_Age		-0.006*	-0.006*
		(0.003)	(0.004)
Fa_Midedu		-0.038	-0.039
		(0.026)	(0.027)
Fa_Highedu		-0.032	-0.032
		(0.032)	(0.034)
Mo_Midedu		-0.021	-0.004
		(0.026)	(0.029)
Mo_Highedu		-0.010	0.000
		(0.032)	(0.034)
Household characteristics			
Family size			0.012**
			(0.005)
Hospital distance			-0.001
			(0.003)
Constant	0.382***	0.517***	0.461***
	(0.100)	(0.118)	(0.127)
Observations	1551	1469	1351
Robust F	28.921	14.959	11.721
R-squared	0.056	0.063	0.068

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust F" reports the F-statistics that a robust variance-covariance matrix estimate was used.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 4.5.1 IV estimation (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.312**	0.254	-0.122	0.255	0.216**	-0.263***
	(0.135)	(0.181)	(0.517)	(0.217)	(0.087)	(0.016)
Gender	0.098***	0.025	0.038*	0.075**	-0.012	0.006
	(0.032)	(0.032)	(0.022)	(0.034)	(0.017)	(0.012)
Age	0.039***	0.003	-0.040***	0.082***	-0.000	0.004
	(0.009)	(0.009)	(0.007)	(0.010)	(0.005)	(0.004)
Hukou	0.064	0.050	-0.049	0.061	0.039	-0.020
	(0.064)	(0.058)	(0.043)	(0.067)	(0.032)	(0.028)
Insurance	0.042	-0.015	0.016	0.091**	0.010	-0.026
	(0.037)	(0.038)	(0.029)	(0.040)	(0.021)	(0.017)
Parents characteristics						
Fa_Age	0.016***	0.015***	0.001	0.015***	0.005*	0.001
	(0.004)	(0.004)	(0.003)	(0.004)	(0.002)	(0.002)
Mo_Age	-0.011**	-0.017***	-0.001	-0.010**	-0.002	-0.001
	(0.005)	(0.005)	(0.004)	(0.005)	(0.003)	(0.002)
Fa_Midedu	-0.074	0.014	-0.078**	-0.054	-0.023	0.035**
	(0.068)	(0.058)	(0.037)	(0.069)	(0.025)	(0.015)
Fa_Highedu	0.145	-0.060	0.057	0.150	0.003	-0.016
	(0.120)	(0.088)	(0.088)	(0.119)	(0.068)	(0.060)
Mo_Midedu	-0.259***	-0.091	-0.040	-0.239***	0.012	-0.011
	(0.091)	(0.064)	(0.048)	(0.086)	(0.048)	(0.036)
Mo_Highedu	-0.361**	-0.022	-0.164**	-0.222	-0.642***	0.045
	(0.148)	(0.113)	(0.069)	(0.136)	(0.081)	(0.046)
Household characteristics						
Family size	-0.021	-0.019	0.022*	-0.016	-0.012	0.011**
	(0.018)	(0.017)	(0.013)	(0.019)	(0.009)	(0.005)
Hospital distance	-0.005	-0.003	0.002	-0.001	-0.001	-0.004**
	(0.005)	(0.004)	(0.004)	(0.005)	(0.002)	(0.002)
Constant	0.012	0.249	0.604***	-0.728***	-0.069	0.912***
	(0.172)	(0.171)	(0.143)	(0.186)	(0.108)	(0.074)
Observations	965	965	965	965	965	965
Prob>chi2	0.000	0.044	0.000	0.000	0.034	0.014
Robust Hausman	0.051	0.066	0.102	0.065	0.100	0.122
Sargan and Basmann	0.174	0.709	0.726	0.219	0.326	0.458

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5.2 Sub-sample IV estimation: father migrating (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Fa_Migrants	0.269	0.407***	-0.203	-0.305	0.084	-0.178
	(0.446)	(0.127)	(0.139)	(0.416)	(0.072)	(0.300)
Gender	0.120**	0.049	0.044**	0.090*	0.010	-0.001
	(0.049)	(0.049)	(0.022)	(0.048)	(0.024)	(0.015)
Age	0.037***	-0.000	-0.040***	0.081***	0.001	0.004
	(0.010)	(0.011)	(0.008)	(0.010)	(0.006)	(0.004)
Hukou	0.045	0.080	-0.067	0.044	0.050	-0.016
	(0.083)	(0.078)	(0.056)	(0.082)	(0.039)	(0.031)
Insurance	0.025	-0.029	0.028	0.101***	-0.004	-0.034*
	(0.045)	(0.048)	(0.035)	(0.039)	(0.024)	(0.018)
Fathers characteristics						
Fa_Age	0.007**	0.001	0.001	0.008**	0.004**	0.001
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.001)
Fa_Midedu	-0.132*	-0.010	-0.081**	-0.115**	-0.026	0.038***
	(0.070)	(0.061)	(0.039)	(0.054)	(0.028)	(0.013)
Fa_Highedu	-0.070	-0.141	0.015	-0.010	-0.018	-0.002
	(0.135)	(0.105)	(0.080)	(0.126)	(0.064)	(0.054)
Household characteristics						
Family size	-0.030	-0.031	0.024	-0.025	-0.019	0.006
	(0.029)	(0.028)	(0.020)	(0.030)	(0.014)	(0.012)
Hospital distance	-0.006	-0.003	0.002	-0.001	-0.001	-0.003
	(0.006)	(0.005)	(0.004)	(0.006)	(0.002)	(0.002)
Constant	-0.007	0.187**	0.558***	-0.772***	-0.106**	0.882***
	(0.169)	(0.080)	(0.142)	(0.173)	(0.053)	(0.066)
Observations	910	910	910	910	910	910
Prob>chi2	0.000	0.056	0.000	0.000	0.085	0.011
Robust Hausman	0.082	0.058	0.062	0.104	0.093	0.108
Sargan and Basmann	0.157	0.790	0.761	0.320	0.602	0.476

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5.3 Sub-sample IV estimation: mother migrating (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Mo_Migrants	0.504*	0.685**	-0.187	0.276	0.594	0.781***
	(0.272)	(0.350)	(0.818)	(0.475)	(0.688)	(0.095)
Gender	0.076***	0.017	0.059**	0.042	-0.014	0.016
	(0.088)	(0.036)	(0.028)	(0.039)	(0.017)	(0.016)
Age	0.042***	0.004	-0.044***	0.088***	0.001	0.001
	(0.012)	(0.012)	(0.010)	(0.013)	(0.006)	(0.005)
Hukou	0.057	0.056	-0.064	0.065	0.030	0.043*
	(0.064)	(0.060)	(0.044)	(0.069)	(0.031)	(0.024)
Insurance	0.053	0.004	0.006	0.103**	-0.002	-0.030*
	(0.047)	(0.041)	(0.034)	(0.048)	(0.020)	(0.018)
Mothers characteristics						
Mo_Age	0.004	-0.004	0.001	0.004	0.003**	-0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)	(0.002)
Mo_Midedu	-0.211**	-0.079	-0.068	-0.204**	0.023	-0.015
	(0.085)	(0.064)	(0.044)	(0.080)	(0.050)	(0.040)
Mo_Highedu	-0.316**	-0.110	-0.103**	-0.163	-0.058***	0.040**
	(0.144)	(0.102)	(0.041)	(0.133)	(0.020)	(0.018)
Household characteristics						
Family size	-0.023	-0.031	0.029	-0.017	-0.007	-0.011**
	(0.025)	(0.024)	(0.020)	(0.026)	(0.011)	(0.005)
Hospital distance	0.001	0.000	0.000	0.007	0.000	-0.004
	(0.005)	(0.005)	(0.004)	(0.005)	(0.002)	(0.003)
Constant	0.078	0.377*	0.559***	-0.716***	-0.084	0.958***
	(0.223)	(0.207)	(0.172)	(0.217)	(0.106)	(0.079)
Observations	824	824	824	824	824	824
Prob>chi2	0.000	0.041	0.001	0.000	0.004	0.016
Robust Hausman	0.056	0.045	0.068	0.057	0.102	0.138
Sargan and Basmann	0.636	0.910	0.958	0.410	0.318	0.613

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5.4 Sub-sample IV estimation: both parents migrating (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Both_Migrants	0.226	0.053	-0.623	0.190	0.304***	-0.172**
	(0.284)	(0.239)	(0.443)	(0.345)	(0.055)	(0.080)
Gender	0.073**	0.010	0.050**	0.059*	-0.027*	0.019
	(0.031)	(0.030)	(0.023)	(0.033)	(0.014)	(0.015)
Age	0.038***	0.004	-0.041***	0.085***	-0.002	0.003
	(0.009)	(0.009)	(0.008)	(0.010)	(0.006)	(0.005)
Hukou	0.017	0.020	-0.035	0.020	0.022	-0.008
	(0.048)	(0.046)	(0.034)	(0.053)	(0.026)	(0.022)
Insurance	0.037	-0.025	0.019	0.094**	0.003	-0.027
	(0.039)	(0.040)	(0.031)	(0.042)	(0.021)	(0.019)
Parents characteristics						
Fa_Age	0.020***	0.013**	-0.001	0.020***	0.010**	0.001
	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)	(0.002)
Mo_Age	-0.012**	-0.014***	0.000	-0.012**	-0.004	-0.001
	(0.005)	(0.005)	(0.004)	(0.005)	(0.003)	(0.002)
Fa_Midedu	-0.064	0.012	-0.071*	-0.025	-0.026	0.042***
	(0.064)	(0.058)	(0.038)	(0.068)	(0.024)	(0.014)
Fa_Highedu	0.219**	-0.016	0.066	0.216*	0.028	-0.028
	(0.101)	(0.087)	(0.103)	(0.120)	(0.070)	(0.065)
Mo_Midedu	-0.217**	-0.074	-0.056	-0.224***	0.028	-0.026
	(0.085)	(0.061)	(0.050)	(0.084)	(0.048)	(0.038)
Mo_Highedu	-0.423***	-0.070	-0.156**	-0.268*	-0.062	0.059
	(0.144)	(0.105)	(0.076)	(0.137)	(0.051)	(0.048)
Household characteristics						
Family size	-0.001	-0.014	0.016	0.001	-0.002	-0.001
	(0.013)	(0.013)	(0.011)	(0.014)	(0.007)	(0.007)
Hospital distance	-0.004	-0.003	0.002	0.002	-0.001	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.003)
Constant	-0.101	0.231	0.609***	-0.881***	-0.147	0.959***
	(0.204)	(0.209)	(0.172)	(0.230)	(0.127)	(0.094)
Observations	841	841	841	841	841	841
Prob>chi2	0.000	0.033	0.000	0.000	0.023	0.003
Robust Hausman	0.112	0.140	0.108	0.170	0.134	0.283
Sargan and Basmann	0.244	0.851	0.881	0.322	0.178	0.535

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5.5 IV estimation (2SLS, 2014)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Migrants	0.453***	0.376***	-0.439**	0.386**	0.162	-0.511***
	(0.117)	(0.065)	(0.215)	(0.181)	(0.149)	(0.081)
Gender	0.088***	0.012	0.096***	0.054*	0.005	-0.010
	(0.030)	(0.027)	(0.020)	(0.028)	(0.016)	(0.029)
Age	-0.031***	-0.006	-0.030***	-0.022***	-0.006	-0.000
	(0.009)	(0.008)	(0.006)	(0.008)	(0.005)	(0.009)
Hukou	0.221***	0.144**	-0.039	0.204***	0.041	-0.050
	(0.069)	(0.062)	(0.045)	(0.066)	(0.034)	(0.064)
Insurance	0.061	-0.012	-0.008	0.066*	0.035	-0.046
	(0.039)	(0.032)	(0.028)	(0.038)	(0.023)	(0.040)
Parents characteristics						
Fa_Age	0.001	0.002	0.001	-0.001	0.001	-0.008*
	(0.005)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
Mo_Age	-0.002	0.002	-0.007*	0.003	-0.003	0.003
	(0.006)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
Fa_Midedu	0.044	-0.032	0.010	0.017	0.002	-0.009
	(0.055)	(0.044)	(0.040)	(0.054)	(0.029)	(0.056)
Fa_Highedu	0.049	-0.109**	0.062	0.115*	0.013	-0.132**
	(0.070)	(0.049)	(0.051)	(0.069)	(0.038)	(0.064)
Mo_Midedu	-0.022	-0.015	-0.036	0.023	-0.041**	-0.032
	(0.048)	(0.040)	(0.031)	(0.045)	(0.021)	(0.046)
Mo_Highedu	-0.048	0.014	0.013	-0.071	-0.047	0.099*
	(0.065)	(0.054)	(0.042)	(0.061)	(0.030)	(0.057)
Household characteristics						
Family size	-0.014*	-0.014*	-0.001	-0.010	-0.001	0.020**
	(0.008)	(0.007)	(0.006)	(0.008)	(0.004)	(0.008)
Hospital distance	0.006	0.001	-0.005	0.009*	0.003	-0.007
	(0.006)	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)
Constant	0.860***	0.020	0.755***	0.481***	0.151	0.913***
	(0.197)	(0.178)	(0.141)	(0.186)	(0.110)	(0.198)
Observations	1351	1351	1351	1351	1351	1351
Prob>chi2	0.000	0.000	0.000	0.000	0.049	0.040
Robust Hausman	0.021	0.001	0.017	0.070	0.142	0.046
Sargan and Basmann	0.912	0.824	0.139	0.154	0.387	0.647

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5.6 Sub-sample IV estimation: father migrating (2SLS, 2014)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Fa_Migrants	0.575***	0.532***	-0.197	0.593***	0.346***	-0.636***
	(0.026)	(0.017)	(0.189)	(0.071)	(0.019)	(0.018)
Gender	0.096***	0.022	0.104***	0.048*	0.004	-0.021
	(0.034)	(0.033)	(0.021)	(0.028)	(0.017)	(0.032)
Age	-0.027**	0.003	-0.034***	-0.021**	-0.005	-0.005
	(0.011)	(0.011)	(0.007)	(0.009)	(0.006)	(0.011)
Hukou	0.217***	0.162**	-0.029	0.141**	0.025	-0.056
	(0.083)	(0.080)	(0.050)	(0.070)	(0.039)	(0.077)
Insurance	0.066	0.004	-0.005	0.054	0.046*	-0.056
	(0.044)	(0.041)	(0.031)	(0.040)	(0.025)	(0.045)
Fathers characteristics						
Fa_Age	-0.003	-0.001	-0.000	-0.001	-0.002	-0.003
	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.003)
Fa_Midedu	0.016	-0.033	0.014	-0.026	-0.011	-0.004
	(0.060)	(0.053)	(0.038)	(0.052)	(0.028)	(0.058)
Fa_Highedu	0.018	-0.113**	0.064*	0.071	-0.012	-0.064
	(0.062)	(0.051)	(0.036)	(0.052)	(0.032)	(0.060)
Household characteristics						
Family size	-0.020*	-0.019*	-0.004	-0.010	-0.001	0.023**
	(0.011)	(0.010)	(0.006)	(0.009)	(0.005)	(0.010)
Hospital distance	0.006	0.000	-0.004	-0.12**	0.003	-0.006
	(0.006)	(0.005)	(0.003)	(0.005)	(0.003)	(0.006)
Constant	0.934***	0.882***	0.605***	0.661***	0.175*	0.868***
	(0.187)	(0.187)	(0.132)	(0.160)	(0.105)	(0.186)
Observations	1250	1250	1250	1250	1250	1250
Prob>chi2	0.000	0.000	0.000	0.000	0.004	0.000
Robust Hausman	0.052	0.001	0.055	0.045	0.021	0.081
Sargan and Basmann	0.266	0.241	0.122	0.815	0.202	0.536

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5.7 Sub-sample IV estimation: mother migrating (2SLS, 2014)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Mo_Migrants	0.395	0.654***	-0.400***	0.370	0.135	-0.337
	(0.334)	(0.024)	(0.069)	(0.605)	(0.133)	(0.566)
Gender	0.052	-0.020	0.119***	0.033	-0.010	0.015
	(0.035)	(0.036)	(0.033)	(0.035)	(0.021)	(0.033)
Age	-0.040***	-0.010*	-0.020	-0.030*	-0.007	0.008
	(0.015)	(0.006)	(0.007)	(0.015)	(0.010)	(0.014)
Hukou	0.202**	0.112	-0.068	0.232***	0.059	-0.061
	(0.087)	(0.087)	(0.080)	(0.087)	(0.052)	(0.080)
Insurance	0.008	-0.047	0.031	0.040	0.041	-0.025
	(0.050)	(0.026)	(0.047)	(0.050)	(0.018)	(0.046)
Mothers characteristics						
Mo_Age	-0.000	0.005	-0.009**	0.003	-0.002*	-0.004
	(0.005)	(0.005)	(0.004)	(0.005)	(0.001)	(0.005)
Mo_Midedu	-0.026	-0.054	0.010	0.021	-0.053*	-0.017
	(0.059)	(0.061)	(0.055)	(0.057)	(0.027)	(0.054)
Mo_Highedu	0.010	0.009	0.011	0.013	-0.060*	0.041
	(0.062)	(0.056)	(0.054)	(0.063)	(0.035)	(0.059)
Household characteristics						
Family size	-0.013	-0.011	0.001	-0.015	-0.001	0.016*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.006)	(0.009)
Hospital distance	0.007	0.004	-0.005	0.007	0.006	-0.007
	(0.006)	(0.005)	(0.005)	(0.006)	(0.004)	(0.005)
Constant	1.021***	0.205	0.670***	0.542***	0.095	0.706***
	(0.181)	(0.182)	(0.169)	(0.179)	(0.112)	(0.177)
Observations	1221	1221	1221	1221	1221	1221
Prob>chi2	0.003	0.000	0.001	0.003	0.000	0.058
Robust Hausman	0.113	0.014	0.003	0.113	0.072	0.210
Sargan and Basmann	0.532	0.290	0.604	0.361	0.962	0.189

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5.8 Sub-sample IV estimation: both parents migrating (2SLS, 2014)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Both_Migrants	0.232*	0.123**	-0.105**	0.214	0.091	-0.354*
	(0.157)	(0.068)	(0.035)	(0.369)	(0.101)	(0.182)
Gender	0.070**	0.004	0.101***	0.049*	-0.012	-0.008
	(0.030)	(0.026)	(0.021)	(0.030)	(0.016)	(0.030)
Age	-0.031***	-0.008	-0.027***	-0.020**	-0.002	0.000
	(0.009)	(0.008)	(0.006)	(0.009)	(0.005)	(0.009)
Hukou	0.164***	0.078*	-0.011	0.179***	0.026	-0.012
	(0.045)	(0.040)	(0.034)	(0.047)	(0.024)	(0.047)
Insurance	0.055	-0.017	-0.021	0.069*	0.045**	-0.052
	(0.037)	(0.030)	(0.027)	(0.040)	(0.019)	(0.040)
Parents characteristics						
Fa_Age	0.002	0.006	0.001	-0.002	0.001	-0.005
	(0.005)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
Mo_Age	-0.001	0.003	-0.010**	0.005	-0.002	-0.003
	(0.006)	(0.006)	(0.004)	(0.006)	(0.003)	(0.006)
Fa_Midedu	0.019	-0.048	0.030	0.001	-0.012	0.001
	(0.052)	(0.042)	(0.042)	(0.053)	(0.027)	(0.055)
Fa_Highedu	0.025	-0.121**	0.055	0.103	0.016	-0.105
	(0.070)	(0.049)	(0.049)	(0.070)	(0.038)	(0.065)
Mo_Midedu	-0.013	-0.018	-0.021	0.022	-0.043*	-0.034
	(0.047)	(0.038)	(0.034)	(0.047)	(0.022)	(0.048)
Mo_Highedu	-0.040	0.012	0.025	-0.065	-0.055*	0.098*
	(0.065)	(0.054)	(0.045)	(0.064)	(0.030)	(0.059)
Household characteristics						
Family size	-0.007	-0.005	-0.007*	-0.007	0.000	0.013*
	(0.007)	(0.006)	(0.004)	(0.007)	(0.004)	(0.007)
Hospital distance	0.008*	0.003	-0.004	0.009*	0.005*	-0.007
	(0.005)	(0.004)	(0.004)	(0.005)	(0.002)	(0.005)
Constant	0.849***	-0.103	0.845***	0.455**	0.093	0.996***
	(0.219)	(0.191)	(0.162)	(0.217)	(0.121)	(0.227)
Observations	1179	1179	1179	1179	1179	1179
Prob>chi2	0.000	0.041	0.000	0.000	0.109	0.091
Robust Hausman	0.071	0.008	0.008	0.048	0.106	0.056
Sargan and Basmann	0.936	0.719	0.178	0.138	0.317	0.544

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.8.1 Sub-sample IV estimation: young children (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.258*	0.162	-0.266	0.510***	0.329***	-0.159
	(0.141)	(0.324)	(0.266)	(0.139)	(0.024)	(0.183)
Gender	0.159***	-0.044	0.094**	0.147***	-0.009	0.003
	(0.049)	(0.043)	(0.037)	(0.055)	(0.023)	(0.023)
Hukou	0.065	0.019	-0.088	0.188**	-0.005	-0.016
	(0.073)	(0.068)	(0.058)	(0.081)	(0.040)	(0.037)
Insurance	0.045	0.017	0.027	0.037	0.016	-0.048*
	(0.061)	(0.061)	(0.050)	(0.072)	(0.031)	(0.028)
Parents characteristics						
Fa_Age	0.016**	0.018***	-0.002	0.011	0.012**	0.000
	(0.007)	(0.007)	(0.005)	(0.008)	(0.006)	(0.003)
Mo_Age	-0.009	-0.017**	0.003	-0.004	-0.010**	-0.001
	(0.007)	(0.007)	(0.005)	(0.008)	(0.005)	(0.004)
Fa_Midedu	-0.035	0.047	-0.056	-0.021	-0.006	0.059***
	(0.094)	(0.084)	(0.059)	(0.109)	(0.033)	(0.014)
Fa_Highedu	0.188	-0.076	0.112	0.155	-0.040	0.061***
	(0.121)	(0.116)	(0.135)	(0.144)	(0.028)	(0.017)
Mo_Midedu	-0.366***	-0.083	-0.085	-0.342***	0.002	-0.037
	(0.119)	(0.093)	(0.059)	(0.120)	(0.052)	(0.063)
Mo_Highedu	-0.585***	-0.149	-0.255**	-0.367*	0.011	0.048***
	(0.188)	(0.094)	(0.109)	(0.205)	(0.035)	(0.015)
Household characteristics						
Family size	-0.009	-0.007	0.015	-0.017**	-0.007	0.018
	(0.023)	(0.022)	(0.019)	(0.008)	(0.013)	(0.014)
Hospital distance	-0.012*	-0.007	-0.007*	0.001	0.001	-0.009
	(0.007)	(0.006)	(0.004)	(0.008)	(0.003)	(0.006)
Constant	0.329*	0.201	0.111	0.013	-0.038	0.988***
	(0.195)	(0.184)	(0.183)	(0.232)	(0.126)	(0.107)
Observations	436	436	436	436	436	436
Prob>chi2	0.000	0.000	0.001	0.000	0.011	0.000
Robust Hausman	0.051	0.233	0.147	0.041	0.127	0.078
Sargan and Basmann	0.363	0.662	0.421	0.450	0.463	0.318

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.8.2 Sub-sample IV estimation: old children (2SLS, 2010)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Migrants	0.155***	0.378***	-0.333	-0.463***	0.071	0.194
	(0.008)	(0.139)	(0.264)	(0.121)	(0.056)	(0.247)
Gender	0.053	0.094*	-0.007	0.005	-0.012	0.013
	(0.044)	(0.054)	(0.029)	(0.042)	(0.026)	(0.015)
Hukou	0.060	0.142	-0.031	-0.133***	0.087	0.008
	(0.115)	(0.119)	(0.071)	(0.049)	(0.062)	(0.041)
Insurance	0.038	-0.018	0.003	0.111**	0.014	-0.008
	(0.048)	(0.059)	(0.030)	(0.046)	(0.028)	(0.020)
Parents characteristics						
Fa_Age	0.016***	0.011**	0.003	0.021***	-0.001	0.001
	(0.005)	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)
Mo_Age	-0.010*	-0.015**	-0.008*	-0.015**	0.006	0.001
	(0.006)	(0.006)	(0.005)	(0.006)	(0.004)	(0.003)
Fa_Midedu	-0.119*	-0.039	-0.086**	-0.102	-0.052***	0.044**
	(0.065)	(0.088)	(0.038)	(0.093)	(0.008)	(0.020)
Fa_Highedu	0.077	-0.085	-0.059*	0.259**	0.041	-0.127
	(0.225)	(0.161)	(0.036)	(0.127)	(0.155)	(0.135)
Mo_Midedu	-0.161	-0.174	0.081	-0.142	-0.019	-0.020
	(0.152)	(0.139)	(0.079)	(0.140)	(0.081)	(0.038)
Mo_Highedu	-0.187	0.120	-0.030*	-0.221	-0.078***	0.122
	(0.208)	(0.172)	(0.016)	(0.208)	(0.014)	(0.091)
Household characteristics						
Family size	-0.027	-0.040	0.031*	-0.005	-0.018	-0.011
	(0.028)	(0.030)	(0.018)	(0.027)	(0.016)	(0.012)
Hospital distance	-0.001	-0.002	0.009**	-0.001	-0.003	-0.002
	(0.007)	(0.007)	(0.004)	(0.005)	(0.003)	(0.002)
Constant	0.558***	0.305	0.154	0.481**	-0.120	0.894***
	(0.200)	(0.256)	(0.152)	(0.215)	(0.133)	(0.065)
Observations	529	529	529	529	529	529
Prob>chi2	0.008	0.000	0.071	0.000	0.082	0.061
Robust Hausman	0.062	0.047	0.082	0.075	0.203	0. 251
Sargan and Basmann	0.316	0.895	0.822	0.828	0.943	0.755

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.8.3 Sub-sample IV estimation: boys (2SLS, 2010)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Migrants	0.222	0.267**	-0.385	0.382	0.014	0.144
	(0.304)	(0.134)	(0.253)	(0.361)	(0.116)	(0.156)
Age	0.019*	0.018*	-0.055***	0.069***	-0.008	0.003
	(0.011)	(0.011)	(0.011)	(0.013)	(0.007)	(0.005)
Hukou	0.114	0.081	-0.051	0.137	0.020	0.053
	(0.074)	(0.084)	(0.060)	(0.089)	(0.042)	(0.034)
Insurance	0.001	-0.093	0.027	0.051	0.010	-0.015
	(0.053)	(0.064)	(0.043)	(0.063)	(0.027)	(0.021)
Parents characteristics						
Fa_Age	0.014***	0.018***	0.003	0.008*	0.007**	0.002
	(0.005)	(0.006)	(0.004)	(0.004)	(0.003)	(0.002)
Mo_Age	-0.005	-0.019***	-0.003	-0.002	-0.001	0.001
	(0.005)	(0.007)	(0.006)	(0.006)	(0.004)	(0.003)
Fa_Midedu	-0.056	0.086	-0.074	-0.039	-0.073***	0.038**
	(0.080)	(0.089)	(0.056)	(0.097)	(0.026)	(0.018)
Fa_Highedu	0.112	-0.099	0.097	0.043	-0.053***	0.039**
	(0.217)	(0.121)	(0.184)	(0.239)	(0.020)	(0.020)
Mo_Midedu	-0.230*	-0.137	0.034	-0.191	0.010	-0.168*
	(0.130)	(0.098)	(0.096)	(0.143)	(0.073)	(0.097)
Mo_Highedu	-0.228	0.258	-0.241*	-0.025	-0.039***	0.562**
	(0.273)	(0.269)	(0.138)	(0.267)	(0.009)	(0.273)
Household characteristics						
Family size	-0.023	-0.040**	0.020	-0.016	-0.001	-0.008
	(0.017)	(0.019)	(0.016)	(0.021)	(0.009)	(0.011)
Hospital distance	-0.006	-0.007	0.009	0.004	-0.002	-0.002
	(0.006)	(0.009)	(0.007)	(0.006)	(0.004)	(0.002)
Constant	0.236	0.089	0.792***	-0.524**	-0.075	0.793***
	(0.193)	(0.214)	(0.197)	(0.223)	(0.123)	(0.110)
Observations	479	479	479	479	479	479
Prob>chi2	0.035	0.057	0.000	0.000	0.013	0.070
Robust Hausman	0.039	0.051	0.140	0.150	0.094	0.274
Sargan and Basmann	0.187	0.493	0.861	0.456	0.885	0.420

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.8.4 Sub-sample IV estimation: girls (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.403***	0.122	-0.265	0.232	0.405*	-0.285***
	(0.095)	(0.637)	(0.485)	(0.227)	(0.301)	(0.022)
Age	0.066***	-0.013	-0.024***	0.099***	0.016	-0.003
	(0.018)	(0.014)	(0.009)	(0.017)	(0.014)	(0.012)
Hukou	0.027	0.010	-0.044	-0.014	0.079	-0.113
	(0.125)	(0.084)	(0.066)	(0.114)	(0.078)	(0.077)
Insurance	0.129*	0.032	0.012	0.165**	0.067*	-0.090*
	(0.071)	(0.056)	(0.038)	(0.069)	(0.044)	(0.046)
Parents characteristics						
Fa_Age	0.021*	0.010	-0.003	0.025**	0.008	-0.005
	(0.011)	(0.008)	(0.005)	(0.010)	(0.008)	(0.007)
Mo_Age	-0.021**	-0.014*	0.001	-0.020**	-0.008	0.001
	(0.010)	(0.008)	(0.004)	(0.009)	(0.007)	(0.006)
Fa_Midedu	-0.067	-0.074	-0.074	-0.059	0.063	-0.031
	(0.135)	(0.089)	(0.061)	(0.119)	(0.076)	(0.068)
Fa_Highedu	0.203	-0.057	0.066	0.259*	0.043	-0.047
	(0.171)	(0.100)	(0.095)	(0.136)	(0.145)	(0.134)
Mo_Midedu	-0.255*	-0.073	-0.090**	-0.252**	0.005	0.030
	(0.144)	(0.071)	(0.038)	(0.115)	(0.099)	(0.079)
Mo_Highedu	-0.391*	-0.162*	-0.141*	-0.307*	0.004	0.008
	(0.203)	(0.090)	(0.081)	(0.181)	(0.120)	(0.116)
Household characteristics						
Family size	-0.034	0.013	0.021	-0.028	-0.040*	0.041
	(0.050)	(0.035)	(0.025)	(0.046)	(0.024)	(0.032)
Hospital distance	-0.004	-0.001	-0.002	-0.004	0.000	-0.007
	(0.009)	(0.005)	(0.003)	(0.008)	(0.005)	(0.006)
Constant	-0.187	0.469	0.461**	-0.930**	-0.172	1.189***
	(0.388)	(0.294)	(0.213)	(0.366)	(0.285)	(0.240)
Observations	486	486	486	486	486	486
Prob>chi2	0.000	0.000	0.025	0.000	0.086	0.043
Robust Hausman	0.052	0.094	0.155	0.230	0.064	0.014
Sargan and Basmann	0.688	0.901	0.606	0.355	0.894	0.785

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.8.5 Sub-sample IV estimation: urban areas (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	-0.581***	0.378	-0.208**	-0.495***	-0.053	0.064
	(0.059)	(0.417)	(0.086)	(0.086)	(0.113)	(1.085)
Gender	0.189***	-0.224	-0.165	0.195***	-0.003	0.043
	(0.053)	(0.906)	(0.834)	(0.061)	(0.171)	(0.064)
Age	0.029*	-0.050	-0.053*	0.048**	0.003	0.007
	(0.18)	(0.113)	(0.029)	(0.020)	(0.021)	(0.010)
Insurance	-0.260	-0.192	-0.225	-0.099	0.035	-0.073
	(0.936)	(0.584)	(0.553)	(0.699)	(0.095)	(0.057)
Parents characteristics						
Fa_Age	0.030**	0.016**	-0.011	0.051***	0.007	0.001
	(0.012)	(0.006)	(0.043)	(0.013)	(0.014)	(0.004)
Mo_Age	-0.027***	-0.008	0.014	-0.048***	0.000	-0.010*
	(0.010)	(0.039)	(0.037)	(0.011)	(0.009)	(0.005)
Fa_Midedu	-0.108*	-0.236	-0.109*	-0.343	-0.056	0.047
	(0.066)	(0.830)	(0.062)	(1.006)	(0.128)	(0.056)
Fa_Highedu	0.232*	0.093	0.043	0.299**	0.047	-0.039
	(0.125)	(0.763)	(0.735)	(0.134)	(0.094)	(0.083)
Mo_Midedu	-0.111	0.194	0.191	-0.161*	0.006	0.020
	(0.076)	(0.812)	(0.800)	(0.094)	(0.122)	(0.057)
Mo_Highedu	-0.341**	-0.435	-0.443	-0.280*	-0.631***	0.103
	(0.147)	(1.409)	(1.295)	(0.164)	(0.177)	(0.116)
Household characteristics						
Family size	0.033*	0.148	0.128	0.033*	-0.022**	0.005
	(0.017)	(0.479)	(0.450)	(0.019)	(0.011)	(0.032)
Hospital distance	-0.033	0.005	0.013	0.005	0.003	-0.001
	(0.020)	(0.109)	(0.101)	(0.135)	(0.022)	(0.008)
Constant	1.159	0.856	0.676	0.526	-0.194	1.162***
	(3.039)	(1.952)	(1.834)	(2.296)	(0.425)	(0.164)
Observations	180	180	180	180	180	180
Prob>chi2	0.085	0.084	0.096	0.034	0.064	0.112
Robust Hausman	0.084	0.165	0.184	0.220	0.308	0.198
Sargan and Basmann	0.989	0.745	0.847	0.975	0.972	0.987

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.8.6 Sub-sample IV estimation: rural areas (2SLS, 2010)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.392***	0.395***	-0.251	0.460***	0.307**	-0.273***
	(0.068)	(0.121)	(0.217)	(0.128)	(0.155)	(0.021)
Gender	0.056**	0.022	0.039*	0.046	-0.016	-0.005
	(0.028)	(0.035)	(0.023)	(0.039)	(0.018)	(0.014)
Age	0.033***	0.007	-0.044***	0.088***	-0.002	0.004
	(0.001)	(0.010)	(0.008)	(0.011)	(0.006)	(0.004)
Insurance	0.030	-0.024	0.043	0.069	-0.004	-0.006
	(0.047)	(0.047)	(0.035)	(0.050)	(0.025)	(0.019)
Parents characteristics						
Fa_Age	0.016***	0.014***	0.001	0.011**	0.005	0.002
	(0.005)	(0.005)	(0.003)	(0.004)	(0.003)	(0.002)
Mo_Age	-0.009*	-0.017***	-0.002	-0.003	-0.002	0.001
	(0.005)	(0.006)	(0.004)	(0.006)	(0.003)	(0.002)
Fa_Midedu	-0.032	0.036	-0.077	-0.004	-0.014	0.034*
	(0.098)	(0.088)	(0.050)	(0.101)	(0.033)	(0.020)
Fa_Highedu	-0.036	-0.109	0.425**	-0.105	-0.066***	0.090
	(0.304)	(0.088)	(0.185)	(0.326)	(0.009)	(0.061)
Mo_Midedu	-0.353*	-0.257***	-0.156**	-0.240	0.007	-0.077
	(0.210)	(0.086)	(0.073)	(0.202)	(0.110)	(0.098)
Mo_Highedu	-0.518***	-0.105	-0.054	-0.430***	-0.048***	-0.027
	(0.111)	(0.092)	(0.050)	(0.110)	(0.008)	(0.029)
Household characteristics						
Family size	-0.026**	-0.019**	0.019	-0.033	-0.010	0.009*
	(0.010)	(0.009)	(0.014)	(0.021)	(0.010)	(0.005)
Hospital distance	-0.004	-0.002	0.003	0.000	-0.001	-0.004**
	(0.006)	(0.004)	(0.004)	(0.006)	(0.002)	(0.002)
Constant	-0.036	0.238	0.634***	-0.850***	-0.024	0.841***
	(0.196)	(0.183)	(0.145)	(0.202)	(0.118)	(0.082)
Observations	785	785	785	785	785	785
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.002
Robust Hausman	0.005	0.056	0.210	0.046	0.088	0.152
Sargan and Basmann	0.211	0.656	0.864	0.153	0.158	0.458

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.9.1 Sub-sample IV estimation: young children (2SLS, 2014)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Migrants	0.347	0.309**	-0.260*	0.462***	0.425*	0.112
	(0.238)	(0.141)	(0.153)	(0.119)	(0.248)	(0.378)
Gender	0.046	-0.034	0.113***	0.049	0.009	-0.017
	(0.039)	(0.037)	(0.034)	(0.043)	(0.024)	(0.038)
Hukou	0.239**	0.145	-0.078	0.285***	0.085	0.055
	(0.098)	(0.095)	(0.082)	(0.109)	(0.057)	(0.093)
Insurance	0.022	-0.020	0.013	-0.056	0.046*	-0.049
	(0.046)	(0.043)	(0.044)	(0.052)	(0.026)	(0.047)
Parents characteristics						
Fa_Age	-0.003	-0.000	0.001	-0.005	-0.006	-0.006
	(0.007)	(0.007)	(0.006)	(0.007)	(0.004)	(0.006)
Mo_Age	-0.001	0.001	-0.013*	0.009	0.004	0.007
	(0.008)	(0.008)	(0.006)	(0.008)	(0.004)	(0.007)
Fa_Midedu	0.023	-0.008	0.007	-0.004	-0.015	0.103
	(0.072)	(0.067)	(0.069)	(0.078)	(0.042)	(0.066)
Fa_Highedu	0.126	-0.041	0.119*	0.173*	0.018	-0.150*
	(0.084)	(0.072)	(0.063)	(0.095)	(0.056)	(0.083)
Mo_Midedu	-0.051	-0.062	-0.078	0.085	-0.067*	-0.063
	(0.067)	(0.058)	(0.052)	(0.074)	(0.037)	(0.065)
Mo_Highedu	-0.112	-0.038	-0.002	-0.044	-0.098**	0.161**
	(0.083)	(0.073)	(0.071)	(0.091)	(0.047)	(0.080)
Household characteristics						
Family size	-0.006	-0.008	0.000	-0.009	0.001	0.017*
	(0.010)	(0.009)	(0.010)	(0.011)	(0.006)	(0.009)
Hospital distance	0.004	-0.001	-0.005	0.007	0.005*	-0.002
	(0.008)	(0.006)	(0.006)	(0.008)	(0.003)	(0.007)
Constant	0.691***	0.477***	0.710***	0.097	0.037	0.524**
	(0.234)	(0.178)	(0.208)	(0.258)	(0.153)	(0.222)
Observations	694	694	694	694	694	694
Prob>chi2	0.063	0.053	0.004	0.025	0.033	0.051
Robust Hausman	0.112	0.045	0.023	0.076	0.125	0.098
Sargan and Basmann	0.842	0.992	0.322	0.065	0.334	0.443

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.9.2 Sub-sample IV estimation: old children (2SLS, 2014)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Migrants	0.539***	0.400***	-0.058	0.526***	0.091	-0.522***
	(0.024)	(0.086)	(0.147)	(0.083)	(0.260)	(0.081)
Gender	0.143***	0.066	0.081***	0.067*	0.009	-0.019
	(0.049)	(0.041)	(0.022)	(0.039)	(0.021)	(0.058)
Hukou	0.221**	0.154*	0.003	0.165**	0.004	-0.146
	(0.103)	(0.082)	(0.047)	(0.083)	(0.042)	(0.114)
Insurance	0.155*	0.015	-0.014	0.226***	0.009	-0.138
	(0.079)	(0.060)	(0.039)	(0.067)	(0.037)	(0.092)
Parents characteristics						
Fa_Age	0.004	0.003	0.002	-0.001	0.007*	-0.012**
	(0.008)	(0.007)	(0.004)	(0.006)	(0.004)	(0.005)
Mo_Age	-0.005	0.001	-0.002	-0.002	-0.009**	0.003
	(0.009)	(0.008)	(0.003)	(0.006)	(0.004)	(0.011)
Fa_Midedu	0.082	-0.102*	0.008	0.041	0.022	-0.144
	(0.087)	(0.057)	(0.045)	(0.076)	(0.042)	(0.096)
Fa_Highedu	-0.045	-0.190***	-0.024	0.048	0.022	-0.104
	(0.120)	(0.067)	(0.052)	(0.102)	(0.054)	(0.113)
Mo_Midedu	-0.006	0.021	0.012	-0.076	-0.023	-0.041
	(0.073)	(0.058)	(0.038)	(0.059)	(0.026)	(0.089)
Mo_Highedu	0.046	0.085	0.036	-0.111	0.003	-0.009
	(0.104)	(0.084)	(0.047)	(0.085)	(0.044)	(0.110)
Household characteristics						
Family size	-0.014	-0.021*	-0.004	-0.009	-0.000	0.034**
	(0.007)	(0.013)	(0.005)	(0.012)	(0.006)	(0.016)
Hospital distance	0.010	0.005	-0.017**	0.012**	-0.001	-0.014
	(0.007)	(0.005)	(0.009)	(0.006)	(0.003)	(0.009)
Constant	0.364*	-0.118	0.062	0.358*	0.139	1.217***
	(0.165)	(0.225)	(0.121)	(0.207)	(0.125)	(0.300)
Observations	657	657	657	657	657	657
Prob>chi2	0.031	0.006	0.051	0.001	0.065	0.000
Robust Hausman	0.027	0.010	0.073	0.090	0.189	0.000
Sargan and Basmann	0.813	0.945	0.261	0.792	0.700	0.917

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.9.3 Sub-sample IV estimation: boys (2SLS, 2014)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.206	0.388***	-0.441***	0.170	0.148*	-0.559**
	(0.285)	(0.084)	(0.032)	(0.369)	(0.078)	(0.225)
Age	-0.009	0.018*	-0.035***	-0.019*	-0.006	-0.001
	(0.011)	(0.011)	(0.010)	(0.011)	(0.007)	(0.012)
Hukou	0.098	0.060	-0.040	0.114	0.029	-0.003
	(0.068)	(0.061)	(0.066)	(0.071)	(0.037)	(0.068)
Insurance	-0.006	-0.038	0.042	0.016	0.021	-0.043
	(0.046)	(0.038)	(0.046)	(0.048)	(0.029)	(0.050)
Parents characteristics						
Fa_Age	0.008	0.006	0.000	0.003	0.000	-0.008
	(0.006)	(0.006)	(0.006)	(0.006)	(0.004)	(0.006)
Mo_Age	-0.013**	-0.005	-0.009*	-0.001	-0.003	0.009
	(0.006)	(0.007)	(0.005)	(0.006)	(0.003)	(0.006)
Fa_Midedu	0.036	-0.025	-0.044	0.018	-0.010	0.014
	(0.075)	(0.061)	(0.070)	(0.083)	(0.033)	(0.080)
Fa_Highedu	0.059	-0.069	0.061	0.188**	-0.007	0.033
	(0.085)	(0.067)	(0.087)	(0.088)	(0.046)	(0.081)
Mo_Midedu	-0.067	-0.054	-0.049	0.002	-0.030	-0.035
	(0.060)	(0.045)	(0.051)	(0.060)	(0.031)	(0.060)
Mo_Highedu	-0.037	0.012	-0.001	-0.117	-0.053	0.002
	(0.082)	(0.070)	(0.077)	(0.083)	(0.035)	(0.080)
Household characteristics						
Family size	-0.011	-0.008	-0.007	-0.004	0.002	0.007
	(0.009)	(0.008)	(0.009)	(0.009)	(0.005)	(0.009)
Hospital distance	-0.006	-0.004	-0.003	0.004	-0.006*	0.005
	(0.008)	(0.006)	(0.007)	(0.008)	(0.004)	(0.008)
Constant	0.937***	-0.146	1.122***	0.501**	0.185	0.660**
	(0.247)	(0.242)	(0.257)	(0.250)	(0.153)	(0.261)
Observations	707	707	707	707	707	707
Prob>chi2	0.000	0.036	0.010	0.055	0.025	0.082
Robust Hausman	0.248	0.038	0.007	0.262	0.194	0.224
Sargan and Basmann	0.948	0.505	0.687	0.646	0.244	0.457

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.9.4 Sub-sample IV estimation: girls (2SLS, 2014)

	(1) Health issue	(2) Underweight	(3) Overweight	(4) Illness	(5) Depression	(6) General health
Migrants	0.495***	0.306**	0.167**	0.525***	0.140	-0.539***
	(0.023)	(0.134)	(0.075)	(0.039)	(0.254)	(0.064)
Age	-0.053***	-0.031***	-0.025***	-0.026**	-0.005	-0.002
	(0.014)	(0.011)	(0.007)	(0.012)	(0.007)	(0.014)
Hukou	0.372***	0.194*	0.055	0.290**	0.074	-0.132
	(0.138)	(0.109)	(0.045)	(0.119)	(0.056)	(0.124)
Insurance	0.140**	0.007	-0.058**	0.128**	0.057	-0.051
	(0.067)	(0.051)	(0.025)	(0.061)	(0.039)	(0.067)
Parents characteristics						
Fa_Age	-0.008	-0.002	-0.003	-0.008	0.003	-0.007
	(0.009)	(0.007)	(0.003)	(0.007)	(0.004)	(0.008)
Mo_Age	0.010	0.007	0.001	0.008	-0.003	-0.003
	(0.009)	(0.007)	(0.004)	(0.008)	(0.005)	(0.009)
Fa_Midedu	0.076	-0.024	0.064*	0.027	0.019	-0.036
	(0.085)	(0.060)	(0.036)	(0.072)	(0.046)	(0.084)
Fa_Highedu	0.054	-0.162**	0.087	0.052	0.052	-0.352***
	(0.126)	(0.073)	(0.058)	(0.111)	(0.068)	(0.104)
Mo_Midedu	0.013	0.017	-0.012	0.039	-0.051*	-0.031
	(0.081)	(0.064)	(0.037)	(0.068)	(0.030)	(0.072)
Mo_Highedu	-0.113	0.009	-0.008	-0.062	-0.054	0.240***
	(0.117)	(0.086)	(0.042)	(0.098)	(0.053)	(0.093)
Household characteristics						
Family size	-0.021	-0.018	-0.003	-0.014*	-0.008	0.044***
	(0.017)	(0.013)	(0.006)	(0.008)	(0.008)	(0.015)
Hospital distance	0.018***	0.006	-0.002	0.015**	0.012*	-0.018***
	(0.007)	(0.006)	(0.003)	(0.006)	(0.006)	(0.006)
Constant	0.931***	0.285	0.417***	0.579**	0.101	1.107***
	(0.298)	(0.221)	(0.143)	(0.253)	(0.154)	(0.287)
Observations	644	644	644	644	644	644
Prob>chi2	0.000	0.013	0.012	0.001	0.057	0.002
Robust Hausman	0.023	0.054	0.046	0.086	0.099	0.055
Sargan and Basmann	0.572	0.445	0.530	0.193	0.937	0.803

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.9.5 Sub-sample IV estimation: urban areas (2SLS, 2014)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.404***	-0.145	-0.451	0.624***	-0.184***	0.015***
	(0.090)	(0.192)	(0.080)	(5.209)	(0.069)	(0.001)
Gender	-0.042	-0.163	0.155***	-0.144	-0.011	0.129
	(0.121)	(0.175)	(0.040)	(0.201)	(0.047)	(0.207)
Age	-0.036**	-0.025**	-0.014	-0.033	0.001	0.011
	(0.015)	(0.01)	(0.031)	(0.036)	(0.009)	(0.035)
Insurance	0.114	0.087	-0.141	0.112*	-0.006	-0.210
	(0.127)	(0.173)	(0.184)	(0.059)	(0.061)	(0.208)
Parents characteristics						
Fa_Age	0.010	0.021	0.010*	0.029	-0.002	-0.021
	(0.024)	(0.030)	(0.006)	(0.037)	(0.010)	(0.037)
Mo_Age	-0.020*	0.016***	-0.002	-0.032	-0.001	0.014
	(0.009)	(0.005)	(0.028)	(0.030)	(0.008)	(0.030)
Fa_Midedu	0.059	0.149	-0.097	0.127	-0.092*	-0.158
	(0.169)	(0.232)	(0.239)	(0.273)	(0.048)	(0.278)
Fa_Highedu	0.070	-0.116*	-0.062	0.238	-0.031	-0.258
	(0.153)	(0.064)	(0.213)	(0.241)	(0.081)	(0.246)
Mo_Midedu	-0.036	-0.080	-0.117**	-0.011	-0.016	-0.035
	(0.088)	(0.111)	(0.054)	(0.136)	(0.044)	(0.128)
Mo_Highedu	-0.043	-0.053	-0.016	-0.091	-0.015	0.112
	(0.086)	(0.083)	(0.090)	(0.114)	(0.049)	(0.101)
Household characteristics						
Family size	-0.016	-0.021	-0.025**	-0.030	0.019***	0.042**
	(0.019)	(0.027)	(0.010)	(0.032)	(0.006)	(0.012)
Hospital distance	0.042**	-0.001	-0.029**	0.038*	0.003	0.010
	(0.021)	(0.019)	(0.014)	(0.020)	(0.008)	(0.022)
Constant	1.471***	-0.163	1.287**	0.901	0.149	0.846
	(0.432)	(0.575)	(0.646)	(0.692)	(0.199)	(0.713)
Observations	318	318	318	318	318	318
Prob>chi2	0.038	0.080	0.069	0.078	0.159	0.175
Robust Hausman	0.324	0.083	0.056	0.135	0.485	0.101
Sargan and Basmann	0.539	0.620	0.850	0.296	0.968	0.451

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.9.6 Sub-sample IV estimation: rural areas (2SLS, 2014)

	(1)	(2)	(3)	(4)	(5)	(6)
	Health issue	Underweight	Overweight	Illness	Depression	General health
Migrants	0.510***	0.354***	-0.169	0.482***	0.272**	-0.368
	(0.016)	(0.095)	(0.179)	(0.113)	(0.132)	(0.291)
Gender	0.123***	0.034	0.086***	0.079**	0.016	-0.015
	(0.037)	(0.031)	(0.020)	(0.033)	(0.019)	(0.033)
Age	-0.028***	-0.002	-0.030***	-0.019*	-0.007	-0.001
	(0.011)	(0.009)	(0.006)	(0.010)	(0.006)	(0.010)
Insurance	0.046	-0.017	0.007	0.038	0.039	-0.020
	(0.050)	(0.039)	(0.031)	(0.046)	(0.030)	(0.047)
Parents characteristics						
Fa_Age	-0.001	0.003	-0.002	-0.003	0.000	-0.013**
	(0.006)	(0.006)	(0.003)	(0.005)	(0.003)	(0.005)
Mo_Age	0.003	-0.003	-0.001	0.008*	-0.002	0.008
	(0.007)	(0.006)	(0.004)	(0.004)	(0.004)	(0.006)
Fa_Midedu	0.051	-0.125*	-0.021	0.069	0.030	-0.012
	(0.083)	(0.068)	(0.048)	(0.074)	(0.045)	(0.079)
Fa_Highedu	0.108	-0.127	0.102	0.201	0.013	-0.166
	(0.178)	(0.101)	(0.112)	(0.149)	(0.084)	(0.118)
Mo_Midedu	-0.022	-0.004	0.007	-0.006	-0.042	0.023
	(0.070)	(0.052)	(0.039)	(0.060)	(0.029)	(0.058)
Mo_Highedu	-0.089	0.026	0.041	-0.074	-0.073*	0.100
	(0.125)	(0.100)	(0.069)	(0.105)	(0.043)	(0.098)
Household characteristics						
Family size	-0.014**	-0.011	0.001	-0.007	-0.006	0.012
	(0.005)	(0.008)	(0.006)	(0.009)	(0.005)	(0.009)
Hospital distance	0.004	0.001	-0.004	0.007	0.003	-0.007
	(0.006)	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)
Constant	0.697***	0.100	0.601***	0.305	0.184	0.920***
	(0.223)	(0.190)	(0.138)	(0.200)	(0.125)	(0.208)
Observations	1033	1033	1033	1033	1033	1033
Prob>chi2	0.008	0.052	0.000	0.047	0.076	0.085
Robust Hausman	0.009	0.010	0.065	0.133	0.103	0.209
Sargan and Basmann	0.770	0.843	0.184	0.332	0.317	0.930

The heteroscedasticity-robust standard error is reported in the brackets.

"Robust Hausman" reports the p-value of the endogeneity test after 2SLS with a robust variance-covariance matrix estimate.

"Sargan and Basmann" reports the p-value of the overidentification test after 2SLS with a robust variance-covariance matrix estimate.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix 4.1 CDC children and teens BMI-for-age growth chart

Table A4.1.1 CDC children and teens BMI-for-age growth chart by gender

	Male BMI		Female BMI	
Age	5th Percentile	85th Percentile	5th Percentile	85th Percentile
2	14.73732	18.16219	14.39787	18.01821
3	14.35767	17.37639	14.03016	17.21564
4	14.05366	16.94533	13.73516	16.81606
5	13.85108	16.83729	13.53336	16.78956
6	13.74144	16.99096	13.42991	17.06531
7	13.71901	17.36192	13.42829	17.5746
8	13.78603	17.90429	13.52777	18.2546
9	13.94476	18.57222	13.72368	19.04952
10	14.19394	19.32497	14.008	19.91061
11	14.52852	20.12835	14.36969	20.79609
12	14.94002	20.95468	14.79484	21.67111
13	15.41692	21.78252	15.26666	22.50777
14	15.94486	22.5964	15.76544	23.28525
15	16.507	23.38657	16.26842	23.98985
16	17.08434	24.14864	16.74965	24.61521
17	17.65613	24.88346	17.17981	25.16251
18	18.20014	25.59716	17.52618	25.64067
19	18.69233	26.30171	17.75286	26.06617
20	19.10551	27.01575	17.82127	26.46243

Appendix 4.2 Mental health score calculation

A4.2.1 Two psychological surveys

Please indicate how often you have felt this way during the last week.

Rarely (less than 1 day) = 0; Some (1-2 days) = 1; Occasionally (3-4 days) = 2;

Most (5-7 days) = 3. *Score need to be reversed.

Overall score = 60, score >= 16 suggests the tendency of depression

A4.2.1.1 Center for Epidemiologic Studies Depression (CES-D)

(1) I was bothered by things that usually don't bother me.

(2) I did not feel like eating; my appetite was poor.

(3) I felt that I could not shake off the blues even with help from my family or friends.

(4*) I felt I was just as good as other people.

(5) I had trouble keeping my mind on what I was doing.

(6) I felt depressed.

(7) I felt that everything I did was an effort.

(8*) I felt hopeful about the future.

(9) I thought my life had been a failure.

(10) I felt fearful.

(11) My sleep was restless.

(12*) I was happy.

(13) I talked less than usual.

(14) I felt lonely.

(15) People were unfriendly.

(16*) I enjoyed life.

(17) I had crying spells.

(18) I felt sad.

(19) I felt that people disliked me.

(20) I could not get going.

A4.2.1.2 Kessler Psychological Distress Scale (K6)

(1) ...nervous?

(2) ...hopeless?

(3) ...restless or fidgety?

(4) ...so depressed that nothing could cheer you up?

(5) ...that everything was an effort?

(6) ...worthless?

A4.2.2 Surveys matching

Table A4.2.2.1 Surveys matching

K6	CES-D
(2) ...hopeless?	(6) I felt depressed.
(1) ...nervous?	(12*) I was happy.
(3) ...restless or fidgety?	(11) My sleep was restless.
(4) ...so depressed that nothing could cheer you up?	(18) I felt sad.
(5) ...that everything was an effort?	(7) I felt that everything I did was an effort.
(6) ...worthless?	(20) I could not get going.

Overall score = 18, score >= 8 suggests the tendency of depression.

Chapter 5

Closing Remarks

On the basis of China 2010 Population Census data, more than 100 million children are affected by the parental migration. Most of these children are bearing a long-term effect with an average of 3.74 years (ACWF, 2014). They face mixed problems such as lack of family care, inadequate educational supervision, and not guaranteed safety protection (Yang, 2016). Thus, this thesis set out to study domestic migration and child development in China and focuses on the effect of parental migration on children.

The thesis consists of three empirical essays examined in terms of the inter-generational labour migration effect on children's education and health outcomes. Chapter 2 studies children's educational performance at the destination location when the whole family migrates together. The results show that the migrant children perform weakly relative to the local children, largely due to the *hukou* restrictions that they are unable to enrol to public schools. Amongst

the migrants early arrival does not help ease out some of the disadvantages, and the overall migrant disadvantage may be more long term than transitory. Chapter 3 also studies children's education outcomes but traces back to the source location where only parents migrate and children are left behind. Though migration intended to improve the households' income and welfare, does inflict short-run costs on the household, some of which are reflected on the child's education so that they lack of opportunities to participate in tutorials and show poor performance. Chapter 4 estimates children's health outcomes at the source location and specifies physical, mental, and general health issues. The results suggest that the migrants' households are poor and cannot afford enough nutritious food so that many left-behind children are malnutrition; also due to the separation and limited contacts with parents, they have significant mental problems, and thus they even consider themselves as not healthy.

In addition, we find some similarities as well as differences among these three studies. Firstly, the most common migration type in China is still rural – urban migration where migrants are low educated but pursuing a high income. Secondly, parental migration does promote child development when the child benefits from the advanced knowledge and well-constructed society by migrating together; however, with the improvement in migrating parents' income, we do not find any additional investment on left-behind children's human capital, which is a result of migrants' educational background so that they are short-sighted. Thirdly, children's characteristics such as gender and age are vital regardless of their locations. Once they migrate together, they face the challenge to adapt and integrate into the new environment, whereas those left behind need to share the household burden and take responsibilities. At last, we

cannot ignore the wealth gap and inequality between rural and urban areas in China that essentially affect people's living standards and behaviour when they cope with the consequences of migration.

According to the empirical results, this thesis concludes the following problems and proposes policy recommendations. First of all, the major difficulty to the migrant worker or the children in China is the urban-rural household registration system, *hukou* system. It restricts migrant parents from taking their children together; though some children migrate with the parents, they have very limited access to qualified education. Thus, household registration system reform is urgently needed.

Secondly, at the destination location, the migrant children should have an equal opportunity to access the public school; alternatively, the private school or the migrant school should provide equivalent teaching quality and facilities. Besides, migrant children are somehow discriminated because of their identity and culture; they always feel isolated and hard to integrate into the new environment. Thus, it requires parents, schools, and communities all work together to publicize the migrants' identity equality and children's rights.

Thirdly, at the source location, the local government should complete the social welfare system and construct the caring and support system especially for left-behind children. Though urbanization promotes the country's development, the construction of villages and small towns should not be undervalued. If the local government invests more in the infrastructure and

encourage private enterprises, more job opportunities will be created and therefore people will stay; moreover, the migrants can be attracted and decide to return to their places of origin. Thereby, fewer children are separated from their parents.

At last, relevant legislation should be formulated and implemented. For instance, improving the guardianship system and strengthening guardianship responsibility in the Law of the People's Republic of China on the Protection of Minors; drafting the practicable holiday entitlement scheme for temporary (migrant) workers and regularizing in the People's Republic of China Labor Law.

In summary, migration is inevitable in the process of a country's development. It is the consequence of the urbanization and further promoting economic growth; however, it also causes various social problems. Research on migration is still an ongoing work and any related issues are worth to discover.

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