Education Inequality between Rural and Urban Areas of the People's Republic of China, Migrants' Children Education, and Some Implications

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Education inequality between the rural and urban areas of the People's Republic of China (PRC)—a potential bottleneck for human capital accumulation—has long been of interest to researchers and policymakers. This paper uses data from the China Family Panel Survey (CFPS) and the Rural–Urban Migration in China (RUMiC) survey to compare the education performance of rural children, children of rural-to-urban migrants, and urban children over the period 2009–2010. Results show that education performance of rural children and migrants' children is significantly lower than that of their urban counterparts even after accounting for differences in personal attributes such as nutrition and parenting style. This provides useful insights for policymaking to reduce rural–urban education inequality and assist human capital accumulation in the PRC.

Keywords: education inequality, rural-to-urban migration, human capital accumulation
JEL codes: I24, O18, P36

I. Introduction

Over the past 3 decades, the People's Republic of China (PRC) has experienced dramatic economic growth. Between 1978 and 2013, gross domestic product (GDP) grew by more than 10% a year on average in the country, which is about three times the growth of Organisation for Economic Co-operation and Development (OECD) countries. As a consequence, the PRC has become the second largest economy in the world since 2011, second only to the United States. However, the period of "miraculous" economic growth appears to be nearing its end. Since 2011, the annual GDP growth rate has declined from 12.0% to 7.7% in the PRC, and the

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declining trend seems to be continuing over time. This has aroused concern that the country would fall into the "middle-income trap."

For decades, the PRC's economic growth has been criticized for its reliance on raising input usage with relatively low productivity improvement (Wu, Ma, and Guo 2014). Substantial rural-to-urban migration provides a large amount of unskilled labor and a relatively high rate of return (because of relatively low wages), encouraging public and private investment. When there is strong demand from the international market, labor-intensive manufacturing production can be easily duplicated, which in turn drives economic growth. However, this kind of growth is not sustainable from an economic perspective. As the population dividend diminishes and environmental concerns and international competition intensify, increasing input usage through low wages and rising investment can no longer fuel economic growth in the PRC as they did in the 1980s and 1990s.

In neoclassical economic growth theory, long-term development relies on productivity improvements driven primarily by human capital accumulation. This implies that, to maintain rapid growth and escape the so-called "middle-income" trap, the PRC needs to increase production efficiency and upgrade industries in order to make them high-valued, service-based, and innovation-based. However, recent statistics show that total factor productivity (TFP) in the PRC's industrial sector has been extremely low, while manufacturing production has been dominated by labor-intensive production techniques (Wu, Ma, and Guo 2014). A shortage of skilled labor supply serves as a major bottleneck for productivity improvement and economic transformation in the country.

Compared to other developing countries, human capital accumulation cannot meet the requirements of economic development in the PRC. Based on the 2005 1% Population Sampling Survey (conducted by National Bureau of Statistics, NBS for short), the number of years of schooling of the country's labor force was 8.6 years on average, while only 25% of the labor force (aged between 15 and 65) had an education level of junior high school or above. This implies that there is a large gap in human capital endowment between the PRC and Asian countries that have escaped the middle-income trap such as Japan and the Republic of Korea (Rozelle 2013). Among others, significant disparities in education between rural and urban areas could be an important factor in the PRC, affecting human capital accumulation at the national level. However, little is known about how education inequality between rural and urban areas has changed over time and only a few studies have been carried out to examine the education of migrants' children.

This paper uses data from the 2010 China Family Panel Survey (CFPS) and the 2009 Rural–Urban Migration in China (RUMiC) survey to compare education performance of rural children and urban children between 2009 and 2010. In the analysis, we distinguish rural-to-urban migrants' children from those of rural non-migrants and urban residents. The results show that education performance of rural children (including those of rural non-migrants and rural-to-urban migrants) is

significantly lower than their urban counterparts. Although attributes of different groups such as nutrition, parenting style, and education quality have played important roles in explaining inequality between rural and urban children, the remaining unexplained education disparity is still substantial.

Compared to previous research, this paper is the first to consider migrants' children separately when analyzing education inequality between rural and urban areas of the PRC. To reduce measurement errors associated with self-assessment, we use test scores in a unique dataset, namely CFPS, to measure education performance of children of different groups. In addition, the analysis to some extent also accounts for personal attributes and their effects in identifying education inequality across groups. The findings obtained from this study not only provide useful insights on potential education reforms in the PRC but also help to inform other developing countries with similar experiences.

II. Education Inequality in Rural and Urban Areas of the People's Republic of China

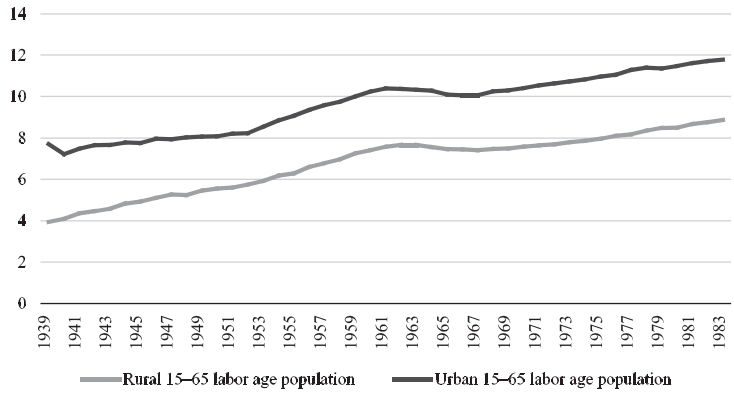
Since 1978, the PRC has exerted great effort to improve education level of the labor force in both rural and urban areas by increasing public investment in education. However, like most other developing countries experiencing economic transition, education inequality is still widely observed between rural and urban areas. Income disparity, various institutional barriers, and different parenting styles, among others, are regarded as potential causes of education inequality. With the increased migration of rural labor into cities in recent years, education inequality between rural and urban areas of the PRC has started to negatively affect human capital accumulation in the urban labor market. This section briefly summarizes education inequality between rural and urban areas in the country and the education performance of rural-to-urban migrants' children.

A. Education Disparity between Rural and Urban Areas

Although the 9-year compulsory education policy was implemented simultaneously throughout the whole country in 1985, the effect of this policy on education attainment in rural and urban areas of the PRC significantly differed. Between 1985 and 2005, average education levels of rural and urban populations both increased, but the latter grew more quickly than the former. As a consequence, the gap in education levels of the labor force in rural and urban areas of the country widened over the period.

There is a substantial gap in the average number of years of schooling between the rural and urban labor force, and this has not diminished over time. Figure 1 compares the average years of schooling of various birth cohorts of the rural and

Figure 1. **Average Years of Schooling for Each Birth Year of the Rural and Urban Labor Force in 2005**



Source: Authors' calculations based on the 2005 1% Population Sampling Survey of the PRC (from the National Bureau of Statistics).

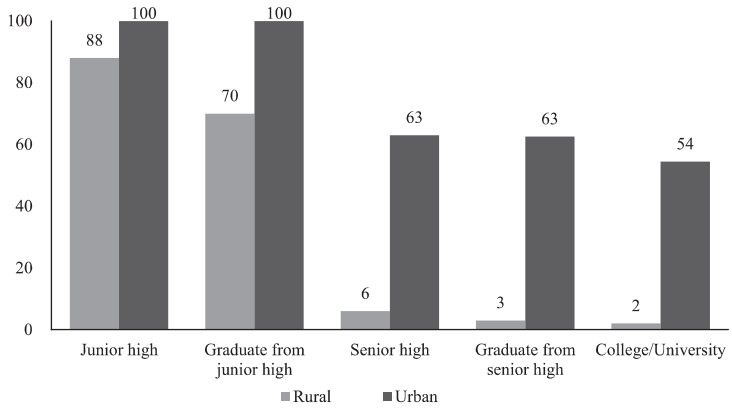
urban labor force using the 2005 1% Population Sampling Survey data. For those aged 15–65 years old, the average years of schooling increased from 4 to nearly 8 for the rural labor force and from 7 to 12 for the urban labor force. However, the gap in the average years of schooling between the rural and urban labor force does not decrease as cohort age declines. This implies that the urban labor force has more years of schooling than the rural labor force in the PRC, and that the gap has not narrowed over time.

There is also a significant gap in the average enrollment and graduation rates[1] of children (of school age) between the rural and urban population of the PRC, which implies that the educational disparity between rural and urban areas of the country has widened, especially in recent years, after the implementation of the compulsory education policy. Figure 2 compares the average enrollment and graduation rates of three grades (junior high, senior high, and college/university) of students living in rural and urban areas who enrolled in 2010 and graduated in 2012 based on statistics taken from the *China Education Statistical Yearbook* (2010–2013). Compared to Figure 1, Figure 2 provides more information on the effects of the 9-year compulsory education policy on school attendance of the rural population in the PRC, as it includes the birth cohorts after 1983.

As shown in Figure 2, among 100 rural children, 88% completed primary education and entered junior high schools, while the rest (12%) dropped out from primary schools. Moreover, only 70% of those who entered junior high schools completed their study. This means that around 38% of rural children were not able to fulfill the 9-year compulsory education. The finding is consistent with some

[1]Graduation rate is defined as the number of graduated students divided by the number of enrolled students.

Figure 2. **Average Enrollment and Graduation Rates of Junior High, Senior High, and College/University Students in 2010–2012, Rural and Urban**



Note: See Table A1.1 of Appendix 1 for detailed data on the generation of dropout rates for junior and senior high school students.
Source: Ministry of Education. 2009–2013. *China Education Statistical Yearbook*. Department of Development and Planning, Ministry of Education, PRC. Beijing: People's Education Press.

calculations using survey data, which show a high proportion of dropouts from primary and junior high schools (40%–50%). Finally, only 6 of 100 rural children can enter senior high schools, among whom 3 can finally graduate from senior high schools. Around 1–2 rural children had a chance to obtain tertiary education.

In contrast, almost all urban children finished junior high school education, of whom 63% entered senior high schools. Among the urban children who graduated from junior high schools, more than half (54%) entered college for tertiary education. Of those not enrolled in senior high schools, a majority were able to study in vocational or technical schools.

Of course, one should note that the above analysis of education inequality between rural and urban populations of the PRC is subject to two limitations. First, formal education levels do not necessarily link to education performance of rural and urban children. Second, the data used to estimate the enrollment ratio of rural children is likely to suffer from a selection problem.[2] It is therefore necessary to carry

[2] Since the data collected from the *China Educational Statistical Yearbook* (Ministry of Education 2009–2013) are compiled using school location rather than *hukou* registration place of students, there may be miscalculations regarding the enrollment of rural children. For example, rural children may have been given the chance to enter urban schools, in turn increasing enrollment in urban schools while reducing enrollment in rural schools. To reduce this bias, we add the increase in urban enrollment compared to the first grade to rural statistics. However, we still cannot adjust the bias for first grade enrollment rate because of the absence of *hukou* information for admitted students at each school level. As a result, the statistics illustrated in Figure 2 may to some extent exaggerate the rural and urban education disparity in terms of enrollment and graduation rates. However, given the substantial difference in the statistics, such measurement bias is unlikely to change the fact that education attainment has not been equally achieved in rural and urban areas of the PRC.

out more thorough comparisons before a strong conclusion on education inequality between rural and urban areas in the PRC can be reached.

B. Rural-to-Urban Migration and Education of Migrants' Children

Rural-to-urban migration is a feature specific to the PRC's economic transformation, one that has played an important role in shaping the structure of rural and urban labor markets in the country over the past 2 decades. Between 1990 and 2010, there had been 164 million workers moving from rural to urban areas, accounting for a third of total urban unskilled labor supply. As more and more rural migrants move into cities, their children's education and the implications for education inequality between rural and urban populations become important issues.

Due to restricted institutional arrangements and discrimination by urban residents, rural-to-urban migrants generally fail to gain access to the urban social welfare system in the PRC (Meng and Zhang 2013). As a consequence, migrants' children are unable to obtain the same opportunities as their urban counterparts in entering the formal education system. The children of migrants mostly receive their education through rural schools, urban informal education institutions, or a mixture of the two. The hybrid education experience, plus an unstable life, reduces the education performance of migrants' children. As rural migrants' children account for a large proportion of rural children, this exacerbates the education inequality between rural and urban populations of the country.

Migrants' children usually have two choices (get left behind or migrate with their parents), and education opportunities faced by various groups of children generally differ. When rural migrants work in urban areas, they can choose to leave their children in their rural hometowns or bring their children into the city for education. In the former case, migrants' parents play a role as the guardian of the children, while in the latter case, migrants have to pay an additional sponsorship fee to send their children to local schools (where most of these schools are for migrants' children). It should be noted that since migrants often need to work for long hours, they cannot spend much time on their children even if they live together.

Compared with children of non-migrants in rural areas, children of migrants seem to have better opportunities to attend schools in urban areas. For example, many migrants' children may have spent a period of time for education in cities, especially at a young age. Given the difference in the quality of education institutions in rural and urban areas, this would be a benefit. However, due to unfair treatment faced by migrants in urban areas and economic concerns, most migrants' children also spend a significant amount of time in rural areas for their education.

As an example, the RUMiC survey shows that economic and discrimination concerns are the two most important reasons why migrants leave their children

in their hometowns. Roughly 36% of the migrants make the choice to leave their children at home because of economic concerns, while 26.5% make the choice because they have no time to take care of their children in urban areas. This may lead to the inconsistent education outcomes of migrants' children in rural and urban areas. In addition, since migrants face a lot of pressures when working in cities, their children (including both those left behind and those migrating) are usually unable to get adequate parental care.

There is no serious empirical evidence regarding the education performance of migrants' children. However, there are those who believe that the performance of migrants' children is likely inferior to their rural/urban counterparts. A primary reason is that mixing rural and urban education leads to inconsistency. Meanwhile, lack of care from parents also makes it hard for migrants' children (especially the left-behind rural children) to obtain good education outcomes. In extreme cases, migrants' children may be prone to commit crimes due to lack of discipline received from their parents (Cameron, Meng, and Zhang 2014).

C. Education Inequality, Rural-to-Urban Migration, and Related Literature

There have been many studies carried out in recent years that explore education inequality between rural and urban areas of the PRC and education performance of migrants' children. A common feature of these studies is the analysis of why education levels of rural and urban residents differ. Two interesting arguments are summarized below.

First, unlike successful neighbors in Asia, the PRC's central government has traditionally spent less on education, particularly of rural residents. For example, Heckman and Li (2003) show that the PRC spent about 2.5% of GDP on education in the 2000s, which was much lower than the amount spent by other developing countries in Asia (about 4%–5%) and the world average (5.2%). Most of the spending had been used to support compulsory education of urban residents.

Second, the relatively low private and social rates of return associated with rural education usually discourage private investment. Rates of return to education in the rural areas of the PRC have on average been perceived to be no more than 5% in the late 1980s and 1990s (Meng 1996, Zhao 1999). This differs from the average for other Asian countries and the world (10%). Given the relatively low return to education, it is not surprising to see rural residents drop from high schools. As an example, well over 90% of students in large cities of the PRC attend senior high school, in contrast to only half of all junior high graduates in poor rural areas (Loyalka et al. 2014, Shi et al. 2014).

As for attempts to examine the education level of migrants' children, most studies have focused on cross-country migration. Edwards and Ureta (2003), Hanson

and Woodruff (2003), and Mansuri (2006) find that international migration can impose positive effects on the performance of migrants' children in education. However, Long (1975), Pribesh and Downey (1999), and de Brauw and Giles (2006) find that international migration generates negative effects on family life and in terms of the continuity of education of migrants' children.

Although significant progress has been made in related data collection, only a few studies have been carried out to examine rural-to-urban migration and its effects on the performance of migrants' children in education in the PRC. These include Ye, Murray, and Yihuan (2005); Han (2003); Liang and Chen (2005); Feng and Chen (2012); and Meng and Yamauchi (2013). These studies generally find an association between the lack of parental care and the mental pressure and the sense of insecurity felt by left-behind children. They also find a lower enrollment rate for children migrating to the cities compared to their urban counterparts as well as to non-migrant children in the migrant-sending communities. In addition, education outcomes of migrant children in cities seem to be significantly worse than those of their local counterparts.

In sum, previous literature provides useful information on education inequality between rural and urban areas in the PRC, and the migration behavior and its effects on education performance of migrants' children. However, few attempts have been made to combine these two issues. This leaves room for this paper to re-examine the effects of education inequality in the country from a migration perspective.

III. Data Sources

The data used in this study comes from two surveys: 2009 RUMiC and 2010 CFPS. Both datasets have their advantages and shortcomings and serve different purposes in our analysis.

The RUMiC survey started to collect information from households in 2008, and 2 years of data have been made available to the public. About 18,000 households were surveyed each year, with the sample split into three groups representing rural residents (8,000 households), rural-to-urban migrants (5,000 households), and urban residents (5,000 households). The sampled households in 2009 were traced from 2008 whenever possible. The random sampling technique and the sample rotation technique were used to fill the gap and to ensure representativeness of the population across regions and over time.

The survey was carried out in both rural and urban areas. In rural areas, nine provinces/municipal cities were selected, including Henan, Jiangsu, Sichuan, Hubei, Anhui, Zhejiang, Guangdong, Hebei, and Chongqing. These provinces/municipal cities accounted for around 47% of emigrants from rural areas in 2000 according to the China Population Census for that year. In urban areas, 15 large and medium-sized cities were selected, namely Shanghai, Hangzhou, Ningbo, Nanjing, Wuxi,

Guangzhou, Shenzhen, Dongguan, Zhengzhou, Luoyang, Hefei, Bengbu, Wuhan, Chongqing, and Chengdu. These cities accounted for around 66% of immigrants into the urban areas in 2000 according to the national census.

The main advantage of RUMiC is that the data collected from the survey provide a good representation of migrants, as they simultaneously provide samples among the three population groups (rural residents, rural-to-urban migrants, and urban residents).[3] Therefore, one can easily distinguish between migrating and left-behind children. Moreover, the survey also provides detailed and consistent information on social and economic behavior of rural residents, rural-to-urban migrants, and urban residents at the individual, household, and regional levels.[4] The information enables us to compare education performance, expenditure, and school choices of migrants' children (including both left-behind children and migrating children) and their rural and urban counterparts.

However, the RUMiC survey has two shortcomings. First, it measures education performance of migrants' children using their math and word test scores in the latest final exam. The measurement could be biased since it involves subjective assessments of performance and differences in test questions. Second, the survey does not provide information on children's mental health, which can affect their education performance. To overcome these two problems, we also use CFPS data.

The CFPS is a nationwide, biannual, and longitudinal survey of communities, families, and individuals launched in 2010. The survey was conducted by the Institute of Social Science Survey (ISSS) of Peking University and covered 25 provinces (except Xinjiang; Xizang; Qinghai; Inner Mongolia; Ningxia; Hainan; Hong Kong, China; Macau, China; and Taipei,China), representing 95% of the total population. In 2010, the baseline survey successfully interviewed 14,789 families, covering 33,600 adults and 8,990 children. The second wave in 2012 surveyed 13,319 families or about 36,062 adults and 8,627 children.[5]

Compared to other surveys on the Chinese family, the CFPS provides much more basic information on each family member as well as various indicators measuring children's education performance and psychological well-being. In particular, unified math, word, and psychological tests were carried out for children aged 10 to 15. The scores obtained from the tests were used to construct a measure of children's education performance and psychological well-being. Specifically, each child participating in the survey needed to answer 24 arithmetic questions in sequence, arranged from easy to hard. The number of correctly answered questions was treated as the child's math test score. The word test scores were obtained in a similar way with

[3] For detailed sampling strategy of the migrant samples, please refer to the following survey website: http://rse.anu.edu.au/research-projects/rural-urban-migration-in-china-and-indonesia/.

[4] The survey collects a large amount of information on migrants (including their hometown, destination, occupation and skills, working experience, and income) and information on their children (under school age), including education level, school choice, and education performance.

[5] The differences between the 2 years mainly come from the combination and split of communities and families as well as the birth and death of individuals.

34 different characters. Psychological well-being status is measured by depression level with six selected psychological questions.

Similar to the RUMiC survey, the CFPS allows for a comparison of children coming from different groups. Using information on individuals' working history in both rural and urban areas, we distinguished the sample into migrants' children (including left-behind and migrating children) and rural/urban residents' children as in the RUMiC data. Specifically, a left-behind child is defined as one living in the rural area with an agriculture *hukou* and at least one parent going out for work, while a rural non-migrant child is defined as one with an agriculture *hukou* but with both parents staying at home. Using this definition may cause bias, however. If the surveyed child lives with a single mother or single father, for instance, he or she will be wrongly categorized as a left-behind child. In this sense, the revealed proportion of left-behind children is likely to be lower than the real proportion.

Due to data constraints, the definitions for migrating children and urban residents' children when using CFPS data are complex and require multifaceted criteria. We define migrating children as those residing in urban areas and born in rural areas with an agriculture *hukou*. Accordingly, urban residents' children are defined as those residing in urban areas and born in urban areas with non-agriculture *hukou*. These definitions, though useful, may cause concern, as they exclude two types of children residing in urban areas. One type comprises those born in urban areas but with agriculture *hukou*, while the other type comprises those born in rural areas but with non-agriculture *hukou*.[6]

Finally, the RUMiC survey and the CFPS each has its own advantages and disadvantages. RUMiC data define rural and urban children in an explicit way and thus provide more reliable information for cross-group comparison. CFPS data meanwhile provide an objective measure of the education performance of children. In this paper, we will use both datasets to examine education inequality between rural and urban populations in the country.

IV. Education Inequality between Rural and Urban Areas of the People's Republic of China: Comparison Analysis

By comparing two measures of education performance (i.e., self-reported and test scores) across sample groups from different datasets, we examined education inequality between rural and urban areas of the PRC. Moreover, left-behind and migrating children are split from rural and urban residents' children, respectively, and their education performances are separately examined. The discussion on the

[6]These children are apparently hard to categorize. An urban-born child with an agriculture *hukou* could be an urban local child or a migrants' child born secretly (without birth certification). A rural-born child with a non-agriculture *hukou* could be a migrating child with *hukou* alteration or an urban child born in a rural area.

Table 1. **Children's School Performance**
(2009 RUMiC)

	Rural Household Survey			Urban Migrant Survey		Urban Household Survey
	Rural	Left-behind	Migrated	Left-behind	Migrated	Urban
Self-reported school performance (%)						
Very good/Above average	41.87	38.72	65.00			60.97
Average	54.68	57.43	30.00			36.82
Below average	3.44	3.85	5.00			2.21
Observations	1,655	1,144	80			994
Self-reported score in Chinese exam during the last semester	82.10	82.49	85.40	84.23	84.93	87.63
(full score = 100)	(11.39)	(10.86)	(12.46)	(10.89)	(11.03)	(10.68)
Observations	1,453	1,025	70	404	517	906
Self-reported score in math exam during the last semester	83.54	83.49	87.01	84.67	85.48	89.36
(full score = 100)	(12.01)	(11.83)	(13.32)	(12.68)	(12.21)	(10.35)
Observations	1,450	1,024	70	399	515	908
Average study time outside school (hours per week)	8.68	7.98	11.32	7.63	7.41	12.48
	(6.90)	(6.56)	(7.23)	(8.40)	(6.22)	(7.62)
Observations	1,247	722	56	423	652	887

Note: Standard deviations are in parentheses.
Source: 2009 Rural–Urban Migration in China Survey.

attributes of different sample groups, such as personal characteristics, individual living and social environments, and institutional arrangements, provides some potential explanation on education inequality.

A. Comparing Education Performance of Children in Rural and Urban Areas

Using data obtained from 2009 RUMiC survey, we construct measures of education performance based on self-reported school performance and test scores and compare these measures for rural and urban children (Table 1).

Education performance of urban children generally exceeds that of rural children. For example, 61% of urban residents believe their children have obtained good or very good school performance (in terms of scores), while 37% believe their children have obtained common school performance. In contrast, only around 40% of rural residents believe their children have obtained good or very good school performance, while about 55% believe their children have obtained common school performance. We find similar results for self-reported scores in individual subjects

Table 2. **Scores on Word and Math Tests of Rural and Urban Children** (2010 CFPS)

	Rural	Urban	Group difference with t-test results
Word test score (full score = 10)	6.144	6.895	−0.751***
	(2.166)	(1.930)	
Primary school	5.417	6.125	−0.708***
	(2.115)	(1.946)	
Junior high school	7.526	7.910	−0.384***
	(1.479)	(1.354)	
Math test score (full score = 10)	4.489	5.025	−0.536***
	(1.886)	(1.790)	
Primary school	3.535	3.891	−0.356***
	(1.495)	(1.405)	
Junior high school	6.298	6.518	−0.219***
	(1.030)	(0.948)	
Observations	1,719	848	

*** = significant at 1%, ** = significant at 5%, * = significant at 10% level.
Note: Standard deviations are in parentheses.
Source: 2010 China Family Panel Survey.

(i.e., in word and math). The average self-reported scores of urban children are 87.6 and 89.4, respectively for word and math (total score is 100), which are higher than those of rural children. This implies that there are significant differences in education performance of children in rural and urban areas of the country, whether it is measured using self-reported school performance or exam scores.

Since self-reported school performance and scores are likely to be affected by subjective judgment and differences in test quality, the comparison analysis using these measures could be biased. To overcome this problem, we also use the objective (word and math) test scores obtained from 2010 CFPS to construct a measure of education performance. Since the two objective tests are only carried out for students from 10 to 15 years of age, inferences from this exercise can only be made for children falling into specific age groups. In addition, to capture the change in education performance over time, we split the sample into two groups: primary school and junior high school.

As shown in Table 2, urban children, on average, perform better in objective test scores than rural children. The gaps in objective test scores between the two groups of children are a standard deviation (SD) of 0.75 for word tests and 0.54 SD for math tests, with both gaps being statistically significant. The finding is consistent with that previously obtained using self-reported school performance and scores, suggesting there is indeed education inequality between rural and urban areas in the country. In addition, the gap in objective test scores between rural and urban children does not change significantly for those enrolled in primary and junior high schools. This implies that education inequality between rural and

Table 3. **Summary Statistics for Rural and Urban Children**
(2010 CFPS)

	Rural	Urban	Group difference with t-test results
Observations	1,719	848	—
%	66.965	33.035	—
Gender			
% Male	49.971	51.297	−0.013
	(0.500)	(0.500)	
Age			
average	12.554	12.456	0.097
	(1.724)	(1.732)	
Health			
Weight(kg)	36.709	40.870	−4.161***
	(10.342)	(11.875)	
Height(cm)	144.156	150.708	−6.552***
	(17.101)	(14.967)	
Degree of depression	1.275	1.143	0.132*
	(1.659)	(1.510)	
Family characteristics			
Mother's years of schooling	4.599	8.579	−3.980***
	(3.870)	(4.444)	
Father's years of schooling	6.365	9.533	−3.168***
	(3.706)	(3.903)	
Annual education expense(Yuan)	844.188	2232.514	−1,388.326***
	(1,283.733)	(3,619.970)	
School attendance			
% Junior high school	34.497	43.160	−8.664***
	(0.475)	(0.496)	
School type			
% Key School	2.618	8.962	−6.344***
	(0.160)	(0.286)	
Class type			
% Key class in a school	6.399	12.618	−6.219***
	(0.245)	(0.332)	

*** = significant at 1%, ** = significant at 5%, * = significant at 10% level.
Note: Standard deviations are in parentheses. Migrating children are included in the urban sample as they were sampled in the cities.
Source: 2010 China Family Panel Survey.

urban areas may not diminish as these children grow older and obtain more formal education.

Previous literature has cited plenty of possible factors based on developed countries' experience to explain education inequality between rural and urban populations in the PRC. These include differences in nutrition, parenting style, genetics, and living environments (Edwards and Ureta 2003; Meng and Yamauchi 2013; Feng and Chen 2012). Although it is hard for us to establish a causal relationship between differences in personal attributes and education inequality because of identification problems, it is still worth reporting the differences in these attributes (Table 3).

As shown in Table 3, weight and height of rural children are generally lower than those of their urban counterparts. On average, rural kids were 4.2 kilograms lighter and 6.5 centimeters shorter than their urban counterparts. As there are no significant differences in sex–age distributions of rural and urban children, substantial differences in weight and height may imply poor nutrition of rural children, which may lead to even worse education outcomes. In addition, there exist significant differences between rural and urban children in terms of their parents' education level. Mothers of rural children spent 4.6 years on average in school, nearly 4 years less than the time spent by mothers of urban children. Similarly, the average number of years of schooling of fathers of rural children was 6.4 years (i.e., primary school), which is 3.2 years less than the average of their urban counterparts (9.5 years of schooling). The extremely low education outcomes of parents of rural children may negatively affect the education performance of rural children. Finally, there exists a significant gap in education investment at the household level between rural and urban populations. On average, the family of rural children spend just CNY844 a year on schooling, or CNY1,388 less than their urban counterparts (up to CNY2,233). In sum, all these differences highlight the education disparity between rural and urban areas in the PRC.

B. Comparing Education Performance of Migrants' Children with Rural and Urban Counterparts

What is the level of education performance of migrating children and how does the migration behavior affect education inequality between rural and urban areas of the PRC? To answer these questions, we compare the education performance of migrating children (measured using self-reported and objective test scores) with that of rural and urban children.

Education performance of migrating children is generally lower than that of urban residents' children but higher than that of rural non-migrants' children. The average objective scores of migrating children for word and math tests are 6.3 and 4.6, respectively, which are higher than the scores of rural non-migrants' children (6.1 and 4.5) but lower than those of urban residents' children (7.2 and 5.2) (Table 4). This is consistent with the findings obtained from subjective assessments of school performance. Moreover, when we split migrants' children into the left-behind group and the migrating group, we find that: (i) there is no strong evidence to show that migrating children's education performance is better than the performance of left-behind children, and (ii) education performance of migrating children is significantly weaker than that of urban residents' children.

The findings above generate important insights on the potential effects of rural-to-urban migration on education inequality between rural and urban areas of the PRC. On one hand, there is no strong evidence to show that migrants' children will be better off if they migrate with their parents to cities and enter

Table 4. **Scores in Word and Math Tests by Children Category**
(2010 CFPS)

	Rural			Urban		
	Left-behind	**Rural non-migrants**	**Group difference with t-test results**	**Migrating**	**Urban local**	**Group difference with t-test results**
Word test score (full score = 10)	6.229	6.105	0.124	6.302	7.213	−0.911***
	(2.044)	(2.220)		(2.114)	(1.744)	
Primary school	5.546	5.355	0.192	5.550	6.455	−0.905***
	(1.975)	(2.178)		(2.137)	(1.748)	
Junior high school	7.572	7.505	0.067	7.404	8.156	−0.752***
	(1.420)	(1.506)		(1.516)	(1.196)	
Math test score (full score = 10)	4.463	4.500	−0.037	4.619	5.242	−0.624***
	(1.840)	(1.908)		(1.882)	(1.701)	
Primary school	3.563	3.522	0.041	3.478	4.129	−0.651***
	(1.459)	(1.513)		(1.428)	(1.337)	
Junior high school	6.234	6.328	−0.093	6.292	6.628	−0.336**
	(1.064)	(1.015)		(1.015)	(0.895)	
Observations	549	1,170		296	552	

*** = significant at 1%, ** = significant at 5%, * = significant at 10% level.
Note: Standard deviations are in parentheses.
Source: 2010 China Family Panel Survey.

urban schools. On the other hand, the significant gap in education performance of migrating children and urban residents' children suggests that education inequality exists between the two groups, working specifically against migrating children in urban areas. Both findings suggest that rural-to-urban migration cannot help mitigate education inequality between rural and urban populations in the country under the current institutional environment.

V. Education Inequality between Rural and Urban Areas of the People's Republic of China: Regression Analysis

Although the descriptive analysis is informative, it does not provide solid evidence on education inequality between rural and urban populations of the PRC or between migrants' and non-migrants' children. In practice, education performance of children is not only affected by the training that they receive from schools but on many other factors such as children's health status, parents' income and education levels, parenting styles, and school characteristics. If these factors are not taken into account, one could overestimate education inequality between rural and urban children and between migrants' and non-migrants' children. To bolster the findings in the comparison analysis, we use the regression analysis that controls for individual attributes to test education inequality between children of different groups.[7]

Three regression scenarios are employed to analyze the objective test scores. In the first scenario, both rural and urban samples are used to examine if there is a gap between the education performance of rural and urban children (with urban children as the base group). In the second scenario, the urban sample is used to examine if there is a gap between the education performance of migrating children and urban residents' children (urban residents' children as the base group). In the third scenario, the migrating children sample is compared with the rural sample to examine whether there is a gap between the education performance of migrating children and rural children (rural children as the base group). The corresponding results for word and math test scores are reported in Tables 5 and 6, respectively. The major findings are summarized below.

First, even after accounting for various personal attributes, family characteristics, and school quality, there are still significant differences in word test scores between rural and urban children. The coefficient of the rural children dummy (from first scenario regressions, column 1 of Table 5) is –0.242 and significant at the 5% level, which suggests that when other conditions are the same, rural children's word test score is 0.242 SD less than that of urban counterparts. Compared with the raw test score gap shown in Table 2, 32% of the raw test score gap between rural and urban children ($6.144–6.895 = -0.751$) can be explained by the difference in

[7]See Appendix 2 for a detailed discussion of the model specification.

Table 5. **Regression Analysis of Word Test Scores of Chinese Children**

Dependent Variable: (standardized word test score)	**(1)** **Rural vs. Urban Children**	**(2)** **Between Urban: Migrating vs. Urban Local Children**	**(3)** **Migrating vs. Rural Children**	**(4)** **Rural vs. Urban Children**	**(5)** **Between Urban: Migrating vs. Urban Local Children**	**(6)** **Migrating vs. Rural Children**
Group dummy (rural = 1, urban = 0)	−0.242**	—	—	−0.450***	—	—
	(0.100)	—	—	(0.149)	—	—
Group dummy (migrating = 1, urban local = 0)	—	−0.392***	—	—	−0.623**	—
	—	(0.151)	—	—	(0.254)	—
Group dummy (migrating = 1, rural = 0)	—	—	0.086	—	—	0.099
	—	—	(0.110)	—	—	(0.221)
Child's age	0.275***	0.311***	0.307***	0.205***	0.280***	0.308***
	(0.039)	(0.067)	(0.040)	(0.051)	(0.071)	(0.041)
Interaction between child age and the group dummy	—	—	—	0.088**	0.087	−0.005
	—	—	—	(0.044)	(0.072)	(0.065)
Dummy for male	−0.386***	−0.266**	−0.341***	−0.388***	−0.268**	−0.341***
	(0.071)	(0.107)	(0.078)	(0.070)	(0.107)	(0.078)
Weight	−0.001	0.004	0.006	−0.000	0.004	0.006
	(0.005)	(0.007)	(0.006)	(0.005)	(0.007)	(0.006)
Height	0.023***	0.024***	0.019***	0.022***	0.023***	0.019***
	(0.004)	(0.007)	(0.004)	(0.004)	(0.007)	(0.004)
Degree of depression	−0.026	−0.019	−0.033	−0.024	−0.017	−0.032
	(0.022)	(0.035)	(0.024)	(0.022)	(0.034)	(0.025)
Mother's years of schooling	0.039***	0.053***	0.052***	0.039***	0.052***	0.052***
	(0.011)	(0.019)	(0.012)	(0.011)	(0.019)	(0.012)
Father's years of schooling	0.051***	0.014	0.048***	0.049***	0.015	0.048***
	(0.012)	(0.020)	(0.012)	(0.012)	(0.020)	(0.012)
Dummy for school level (junior high = 1)	0.680***	0.244	0.609***	0.701***	0.257	0.610***
	(0.119)	(0.205)	(0.123)	(0.119)	(0.205)	(0.123)
Annual education expense	0.030***	0.030***	0.047	0.029**	0.030***	0.047
	(0.011)	(0.011)	(0.030)	(0.011)	(0.012)	(0.030)
Dummy for being in a key school	0.243*	0.265	0.183	0.249**	0.267	0.184
	(0.125)	(0.177)	(0.189)	(0.126)	(0.178)	(0.188)
Dummy for being in a key class of a school	0.278**	0.305**	0.436***	0.292***	0.317**	0.436***
	(0.111)	(0.141)	(0.148)	(0.110)	(0.139)	(0.148)
Constant term	1.929***	1.922**	1.979***	2.206***	2.101**	1.971***
	(0.700)	(0.957)	(0.500)	(0.695)	(0.960)	(0.516)
Control for province	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	2,271	848	2,015	2,271	848	2,015
R-squared	0.406	0.407	0.383	0.407	0.408	0.383

*** = significant at 1%, ** = significant at 5%, * = significant at 10% level.
Note: Robust standard errors are in parentheses.
Source: 2010 China Family Panel Survey.

Table 6. **Regression Analysis of Math Test Scores of Chinese Children**

Dependent Variable: (standardized math test score)	**(1)** **Rural vs. Urban Children**	**(2)** **Between Urban: Migrating vs. Urban Local Children**	**(3)** **Migrating vs. Rural Children**	**(4)** **Rural vs. Urban Children**	**(5)** **Between Urban: Migrating vs. Urban Local Children**	**(6)** **Migrating vs. Rural Children**
Group dummy (rural = 1, urban = 0)	−0.196***	—	—	−0.178	—	—
	(0.073)	—	—	(0.109)	—	—
Group dummy (migrating = 1, urban local = 0)	—	−0.443***	—	—	−0.432**	—
	—	(0.105)	—	—	(0.174)	—
Group dummy (migrating = 1, rural = 0)	—	—	−0.069	—	—	−0.081
	—	—	(0.077)	—	—	(0.144)
Child's age	0.317***	0.387***	0.292***	0.323***	0.388***	0.291***
	(0.030)	(0.047)	(0.031)	(0.037)	(0.049)	(0.031)
Interaction between child age and the group dummy	—	—	—	−0.008	−0.004	0.004
	—	—	—	(0.030)	(0.049)	(0.044)
Dummy for male	0.002	0.025	−0.012	0.002	0.025	−0.012
	(0.052)	(0.080)	(0.057)	(0.052)	(0.080)	(0.057)
Weight	0.005	0.003	0.007*	0.005	0.003	0.007*
	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)
Height	0.009***	0.014***	0.007**	0.009***	0.014***	0.007**
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)
Degree of depression	−0.046***	−0.026	−0.046***	−0.046***	−0.026	−0.046***
	(0.016)	(0.026)	(0.017)	(0.016)	(0.026)	(0.017)
Mother's years of schooling	0.033***	0.004	0.039***	0.033***	0.004	0.039***
	(0.008)	(0.014)	(0.008)	(0.008)	(0.014)	(0.008)
Father's years of schooling	0.017*	0.024*	0.011	0.017**	0.024*	0.011
	(0.009)	(0.014)	(0.009)	(0.009)	(0.014)	(0.009)
Dummy for school level (junior high = 1)	1.569***	1.206***	1.696***	1.567***	1.206***	1.695***
	(0.096)	(0.150)	(0.099)	(0.096)	(0.150)	(0.099)
Annual education expense	0.017	0.019*	0.032	0.017*	0.019*	0.032
	(0.010)	(0.011)	(0.021)	(0.010)	(0.011)	(0.021)
Dummy for being in a key school	0.106	0.100	0.098	0.106	0.100	0.098
	(0.098)	(0.124)	(0.123)	(0.098)	(0.124)	(0.123)
Dummy for being in a key class of a school	0.118	0.028	0.202*	0.117	0.028	0.202*
	(0.085)	(0.116)	(0.110)	(0.085)	(0.115)	(0.110)
Constant term	1.534***	0.841	1.092***	1.509***	0.832	1.099***
	(0.403)	(0.587)	(0.402)	(0.413)	(0.596)	(0.412)
Control for province	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	2,271	848	2,015	2,271	848	2,015
R-squared	0.589	0.641	0.574	0.589	0.641	0.574

*** = significant at 1%, ** = significant at 5%, * = significant at 10% level.
Note: Robust standard errors are in parentheses.
Source: 2010 China Family Panel Survey.

observed attributes included in the regressions. Meanwhile, for the math test score results, the rural–urban education gap is –0.196 with 1% level of significance. The controlled attributes can help explain 26% of the raw test score gap in math between rural and urban local children.

Second, when focusing on the urban sample, we find that urban residents' children have much better education performance than migrating children. The coefficient of the dummy for migrating children (from second scenario regressions, column 2 of Table 5) is –0.392 and significant at the 1% level. Given that the difference in the raw word test scores of the two groups of children is 0.912 (Table 4), the regression results show that 43% of the test score gap can be explained by the regression controls. For the math test regression in column 2 of Table 6, the coefficient of the dummy for migrating children (–0.443) is also negative and significant at the 1% level. Up to 71% of the raw math test score gap (–0.624) can be explained by the controlled characteristics.

Third, the difference in test scores between migrating children and rural residents' children (including both left-behind and rural non-migrants' children) is small and statistically insignificant and likely due to different personal attributes. This suggests that migrating with parents cannot really improve the education performance of migrants' children.

Fourth, the major contributors to the rural–urban education disparity include demographic features, physical health measures, parental education levels, and household education spending. Basically, a child's age positively affects the word test score, with girls often exhibiting better performance. Physical health can generate better education outcomes, while parental education positively correlates with test scores. Other attributes that impact on word and math test scores also include the depression level of the child, which has a strong negative effect on math test scores though little effect on word test scores, and being in a key school, which is positively associated with word test scores but with no significant effect on math test scores.

Fifth, to gauge how the education disparity changes over time, we include an interaction term of the child's age and the group dummy into the regressions. The coefficients of the interaction terms show that the group difference in test scores varies with the age of the children. The results are shown in the last three columns of Tables 5 and 6. As seen in column 4 of Table 5, the coefficient of the interaction term between the rural dummy and age is positive and significant at the 5% level. This suggests that, holding other things constant, the gap in word test scores between rural and urban children is wider for the younger age group. The other interactions are insignificant, which implies that those group differences in test scores would not change with a child's age.

The above findings suggest the following: (i) there exists a substantial disparity in education outcomes of rural and urban children even after controlling for many attributes, (ii) there is no significant difference in education outcomes between rural

children who stay in rural areas and those who migrate with parents and receive their education in urban areas, (iii) migrating children generally have significantly poorer education performance than their urban counterparts although they are educated in the same cities, and (iv) there is evidence to show that the education disparity between rural and urban children tends to be widened for younger age cohorts.

VI. Policy Implications

Improving education performance of children has long been regarded as one of the most important targets of national policy in the PRC because it affects human capital accumulation of the country. However, how to efficiently use limited public resources to achieve this target is still under question. In this analysis, we find that there is still significant inequality in the education performance of children between rural and urban areas of the PRC. In particular, rural-to-urban migration, which had been expected to play an active role in reducing education inequality, could not contribute much to narrow the gap. To date, there is still a significant difference in the education performance of migrating children and urban residents' children. This provides some useful insights for policymaking.

First, it is essential to reduce education inequality between rural and urban populations of the PRC in order to improve average education performance at the national level. Although there are many personal attributes that affect education performance, providing equal rights and access to quality schools is important to improve education inequality between rural and urban areas of the country.

Second, it is important to reduce institutional barriers and discriminative policies against migrating children in urban areas in order to improve their education performance. In our analysis, migrating children do not exhibit better performance in education than left-behind children and rural residents' children, and are unable to catch up with the performance of urban residents' children. In addition to non-education-related factors, such as parenting styles and family characteristics, existing institutional barriers and discriminative policies that restrict migrating children from accessing the urban education system may be a reason. From this perspective, reducing these restrictions may allow more migrating children to improve their education performance and thus contribute to reducing education inequality between rural and urban populations of the PRC.

Third, in addition to reforming the education system, public policies should pay more attention to factors such as family income, children's nutrition, parenting style, and mental health, as these factors can also affect migrant children's education performance. This paper has shown that personal attributes, such as mental health status, play an important role in explaining the difference in math test performance of rural and urban children. Although it is hard to quantify the real effects due to potential identification problems, improving the living conditions of rural

left-behind children and paying more attention to their living environment will definitely help to increase their education performance.

VII. Conclusion

This paper uses CFPS and RUMiC survey data to examine the differences in education performance of children between rural and urban areas of the PRC. In particular, we separately examine the education performance of migrants' children (including both left-behind and migrating children) and compare this to the education performance of their rural and urban counterparts. Results show that there exists a substantial disparity between rural and urban children, with rural-to-urban migration playing a weak role in terms of narrowing the gap. In particular, our analysis shows that education performance of migrating children is significantly worse than that of urban residents' children, which causes some concerns.

As urban birth rate declines and more rural migrants move into cities, rural children are becoming an important part of the urban labor supply. Improving education performance of migrants' children, especially those migrating into cities with their parents, is not only in the interest of migrants but also crucial for human capital accumulation and the long-term economic growth of the PRC. Since there is a large gap in education performance of children in rural and urban areas of the country, further reforms need to be implemented to address the problem.

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*ADB recognizes "China" as the People's Republic of China.

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Appendix 1. Descriptive Statistics on RUMiC Survey and CFPS Data

This appendix provides descriptive statistics of our samples.

Table A1.1. **Calculating the Dropout Rate for Junior High and Senior High School Students by Rural and Urban Areas**

	Total Number of Students Admitted in 2009	1st Grade in 2009	2nd Grade in 2010	3rd Grade in 2011	Graduates in 2012	Overall Dropout Rate	Adjusted Dropout Rate	Dropout Rate, Grades 7–8	Dropout Rate, Grades 8–9	Dropout Rate, before Graduation
Junior high schools										
Total	17,863,912	17,902,174	17,570,301	16,912,985	16,607,751	7.03%	—	1.85%	3.74%	1.80%
Urban	11,553,227	11,576,311	11,590,357	12,962,891	12,968,178	−12.25%	0.00%	−0.12%	−11.84%	−0.04%
Rural	6,310,685	6,325,863	5,979,944	3,950,094	3,639,573	42.33%	20.00%	5.47%	33.94%	7.86%
Senior high schools										
Total	8,303,384	8,316,126	7,946,667	7,960,881	7,915,046	4.68%	—	4.44%	−0.18%	0.58%
Urban	7,708,066	7,720,353	7,415,284	7,631,187	7,651,157	0.74%	—	3.95%	−2.91%	−0.26%
Rural	595,318	595,773	531,383	329,694	263,889	55.67%	—	10.81%	37.96%	19.96%

Source: Author's calculations. Ministry of Education. 2009–2013. *China Education Statistical Yearbook*. Department of Development and Planning, Ministry of Education, PRC. Beijing: People's Education Press.

Table A1.2. **CFPS Summary Statistics—Education-related Features**

	Rural		Urban	
Total no. of observations	1,719		848	
%	66.965		33.035	
	Left-behind	**Rural non-migrants**	**Migrating**	**Urban**
No. of observations by groups	549	1170	296	552
%	31.937	68.063	34.906	65.094
Gender				
% Male	48.998	50.427	52.027	50.906
	(0.500)	(0.500)	(0.500)	(0.500)
Age				
Average years	12.607	12.529	12.689	12.332
	(1.721)	(1.725)	(1.685)	(1.745)
Health				
Weight (kg)	36.526	36.794	38.590	42.092
	(9.939)	(10.529)	(11.900)	(11.690)
Height (cm)	144.501	143.994	146.547	152.938
	(17.152)	(17.082)	(17.201)	(13.101)
Depression	1.392	1.220	1.150	1.140
	(1.721)	(1.626)	(1.419)	(1.558)
Family characteristics				
Mother's years of schooling	4.224	4.774	5.280	10.348
	(3.790)	(3.896)	(3.975)	(3.594)
Father's years of schooling	6.434	3.493	7.057	10.861
	(6.332)	(3.803)	(3.762)	(3.283)
Annual education expense (CNY)	773.244	877.477	1,098.980	2,840.351
	(1,183.061)	(1,327.525)	(1,674.712)	(4,193.070)
School attendance				
% Junior high school	33.698	34.872	40.541	44.565
	(0.473)	(0.477)	(0.492)	(0.497)
School type				
% Key School	2.550	2.650	2.360	12.500
	(0.158)	(0.161)	(0.152)	(0.331)
Class type				
% Key class in a school	6.560	6.320	8.450	14.860
	(0.248)	(0.244)	(0.279)	(0.356)

Note: Standard deviations are in parentheses.
Source: 2010 China Family Panel Survey.

CFPS Data

Table A1.2 shows the basic summary statistics for each child category that we have defined.

Similar to the RUMiC data, boys are more likely to number among the migrating children, while girls are more likely to be among the left-behind children. However, the finding that migrating children tend to be relatively younger than left-behind children no longer holds. This probably occurs because of a province-specific effect, as the RUMiC and the CFPS draw their samples from different regions. The

migration of children from different regions starts in different years, giving rise to differences in the distributions based on children's age when RUMiC and CFPS data are used. Meanwhile, Chinese families' preference for taking care of boys is the same for different regions.

Not surprisingly, children in urban areas are healthier than those in rural areas, as coarsely measured by height and weight. Furthermore, urban local children are healthier than migrating ones. There is a huge difference in the family environment of the different children in terms of education. Urban local children's parents have much greater education experiences than parents of migrating, left-behind, and rural children, and they spend much more resources on their children's education. Under different family backgrounds, parents of children from better environments tend to invest more heavily in education. This contributes to the education gap between groups, and aggravates the severity of the disparities in the next generation.

Finally, migrating, left-behind, and rural non-migrating children are all younger than urban local children on average, so they have larger proportions enrolled in primary school. Conditional on the age distribution of different children categories, school attendance results show that rural children are more likely to delay their enrollment into the school system. Apart from that, rural children face greater restrictions to entry to key schools and classes. The results are a reminder that immediate action should be taken to relieve the education disparity problem before it goes too far.

RUMiC Data

Table A1.3 presents descriptive statistics on school-aged children from the rural, migrant, and urban samples. In particular, the migrant sample is split into the migrating children group and the left-behind children group, and is compared to the rural and urban samples. Statistics compiled using the rural sample in 2009 suggests that around 43% of rural children's parents migrated to urban areas for work. Of the total for migrants' children, around 55% migrated with their parents, while around 45% were left behind (using the urban sample). Compared with the numbers in 2008, the proportion of left-behind children has been declining over time, while that of migrating children has been increasing. This suggests that there are increasingly more children of migrants moving into urban areas for education, hence migrating children have become an important phenomenon in the PRC. There are four characteristics of migrants' children summarized below.

First, boys are more likely to become migrating children, while girls are more likely to become left-behind children. Also, migrating children are relatively younger than left-behind children. In our sample, the male–female ratio of migrating children is significantly higher than that of school-aged migrants' children, which is already greater than 1. This suggests that boys are more likely to migrate with their parents. A possible explanation of this phenomenon is that there is gender selection among

Table A1.3. **RUMiC Summary Statistics—Education-related Features**

	Rural Household Survey			Urban Migrant Survey		Urban Household Survey
Total no. of observations		3,047			1,358	1,058
%		55.78			24.86	19.37
	Rural	**Left-behind**	**Migrated**	**Left-behind**	**Migrated**	**Urban**
No. of observations by groups	1,747	1,216	84	605	753	
%	57.33	39.91	2.76	44.55	55.45	
Gender						
% Male	54.87	55.23	57.83	55.87	56.31	52.89
% School attendance						
Primary school	64.11	64.56	66.67	64.63	65.21	69.85
Junior high school	35.43	34.95	32.14	35.04	34.26	29.96
Dropped out	0.46	0.49	1.19	0.33	0.53	0.19
% Living with						
Both parents	94.96	0	78.57	0	87.52	85.82
Single parents	0	30.02	21.43	28.93	7.17	6.52
Both parents absent	5.04	69.98	0	71.07	5.31	7.66
Total years educated in cities for migrant sample				3.99 (2.88)	4.75 (2.70)	
Observations				143	687	
% School type						
Rural School					9.29	
City Migrant School					27.59	
City Non-migrant School					60.03	
Other					3.1	
Public						92.58
Private						7.12
Other						0.3
% Education quality of schools						
Best in the city/county	3.44	3.23	16.67	3.17	1.48	11.98
Fairly good in the city/county	24.71	18.79	43.59	16.67	25.03	55.49
Average in the city/county	69.86	75.35	39.74	74.83	71.6	32.23
Worse in the city/county	1.99	2.62	0	5.33	1.88	0.3
Observations	1,659	1,144	78	600	743	993
Education expenditure (CNY)						
Total payment for all regular school fees in 2010	880.98 (1,548.08)	996.78 (1,634.91)	1354.07 (1,416.78)	1413.80 (2,048.11)	1778.82 (2,334.82)	1814.18 (3,012.39)
Tuition and other related fees	207.96 (711.24)	202.03 (593.26)	600.47 (1,085.73)	300.08 (580.31)	440.71 (940.99)	611.68 (1,716.46)
Food and accommodation	508.12 (981.47)	636.45 (1,167.65)	686.03 (1,078.92)	718.00 (1,404.12)	737.72 (1,230.19)	780.64 (1,625.41)
Remedial classes at school	69.86 (312.03)	46.00 (280.23)	47.91 (116.03)	92.74 (504.47)	157.47 (962.75)	131.09 (464.50)
Other fees (e.g., school uniform and books)	145.88 (267.13)	147.35 (307.96)	162.25 (263.76)	324.20 (723.98)	413.97 (939.07)	220.73 (645.88)
Supplementary classes outside school	68.68 (430.56)	35.15 (466.01)	153.09 (748.25)	56.52 (352.68)	263.72 (932.58)	1,385.81 (2,729.99)
Sponsorship fees/study fees/school selection fees	53.54 (555.30)	33.56 (391.53)	150.70 (520.13)	68.72 (507.80)	732.90 (3,068.47)	588.00 (3,174.74)

Note: Standard deviations are in parentheses.
Source: 2009 Rural–Urban Migration in China Survey.

migrants' migration decision, with an apparent preference for boys. In addition, the ratio between the number of migrating children and that of left-behind children is lower in middle schools than in primary schools. This implies that migrating parents are more likely to take their younger children with them, leaving their older children in their hometowns. Economic concerns about the education costs of migrating children are an important reason for explaining this phenomenon.

Second, left-behind children have an increasingly lower likelihood of living with one or both of their parents over time relative to migrating children. In 2008, the proportion of left-behind children not living with both of their parents was 56%. However, this proportion increased to 70% in 2010. The proportion of left-behind children living with only one of their parents (usually the mother) has also been declining over time. Grandparents often substitute for the role of parents of left-behind children. In contrast, 88% of migrating children lived with both their parents in 2008, while 7% lived with one of their parents. This pattern did not change much in 2009.

Third, most migrants' children (including both migrating children and left-behind children) experienced going to urban schools, though these episodes were usually short-lived and different from those of their urban counterparts. In our sample, around one-fourth of left-behind children even attended the urban schools, where the average length of experience had been 4 years. For migrating children, the average length of experience in urban schools was 4.75 years, with most staying in urban schools for 3–7 years. Although migrants' children went to urban schools, these urban schools are usually different from those that urban residents' children attend. In our statistics, only 60% of migrating children were able to access public urban schools (which are of relatively lower quality), while the rest (40%) had to attend schools for migrants' children or rural schools. In contrast, around 93% of urban residents' children had access to public urban schools, while the rest (7%) went to high-level private schools.

Fourth, family spending on education was significantly higher for migrants' children than for rural residents' children, though the money was mostly used to cover additional living costs rather than improve education quality. In 2009, the average spending on migrating children's education by their families was nearly CNY1,800 per capita annually, or around 80% more than the average spending for rural residents' children (less than CNY1,000 per capita a year). However, of the total expenditure, about CNY740 was used for food and accommodation; there were still additional costs related to school sponsorships and bench fees.

In contrast, urban residents' children spent about CNY1,814 on education, of which CNY1,400 had been used for additional training courses. This is about 40 times greater than that spent on migrants' children for the same spending categories. On the rural side, spending on the education of left-behind children was higher than that on children of non-migrant families, with the additional money spent on food and accommodations, as left-behind children were more likely to go

to choice boarding schools with extra charge. And the spending on other categories for left-behind children was generally less than rural non-migrants' children. The difference in family education expenditure among groups may suggest that (i) migrating children are vulnerable when educated in cities, as they are generally from low-income families and have to pay an extra fee to access urban schools, reducing resources for their education development; and (ii) left-behind children not only lack parental care but also receive limited spending on their education, which can worsen their education performance. Significant differences in characteristics between migrants' children and rural and urban residents' children may therefore lead to inequality in education.

Appendix 2. Model Specification for Regression Analysis

Regression analysis can be used to quantify the impact of rural-to-urban migration on education performance of migrants' children in a more accurate way than comparison analysis. This is because regressions can net out the effects of migration by controlling for a large number of non-migration factors. The basic regression function in our analysis is specified as

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + \beta_3 Z_i + \beta_4 S_i + \varepsilon_i, \quad (1)$$

where Y_i denotes performance in education or the mental health of child i. We consider three different outcome variables in separate models, including word test scores, math test scores, and depression level scores.

The variable D_i is the group dummy that indicates the group used for comparison—for example, D_i equals 1 if child i is migrating and 0 if he or she is a rural child (or urban local child). X_i denotes a set of children's personal characteristics such as age, gender, physical health status (measured by weight and height), mental health (measured by depression level), and current school level (primary school or junior high school). Z_i represents information on children's families, including the education levels of parents, and annual earnings and expenses in children's education. S_i denotes the characteristics of the school child i attends—for instance, whether or not the child was admitted to a key school or a key class, which may capture the differences in education quality due to school choice. The province fixed effect is also included to capture other unobservable regional disparities that may generate group differences. All three groups of variables (X_i, Z_i, and S_i) are used to control for non-migration factors. Finally, ε_{it} is the residual. The estimate of β_1, which is the main interest of this analysis, captures the impact of rural–urban migration on education outcomes and mental health status of rural children controlling for all other group differences in personal, family, and school characteristics.

Based on Equation (1), we design three regression scenarios for each outcome variable to examine the impact of rural–urban migration on human capital

accumulation of rural children. In the first scenario, we use the rural sample to analyze the difference between the education performance and mental health of left-behind children and rural non-migrants' children (the base group). In the second scenario, we use the urban sample to analyze the difference between the education performance of migrating children and urban local children (the base group). In the third scenario, we combine both rural and urban samples to analyze the gap among migrating children, rural non-migrants' children, urban residents' children, and left-behind children (the base group).

It would also be interesting to see how differences across children's groups vary over time. One way to conduct dynamic analysis using cross-section data is to examine if the age effect on test scores or depression levels significantly differs across various groups. Therefore, we also incorporate an interaction term between the child's age and the group dummy in the equation—i.e., (age–10) multiplied by D_i. The coefficient of the interaction term captures the difference in the age effect between the two groups of children. The group dummy D_i then captures the group difference between left-behind children (or migrating children) and rural local children (or urban local children) at age 10. For example, if the interaction term is positive and significant for the test score regressions, we can claim that the left-behind (or migrating children) are getting better in their test scores relative to their counterparts as their age increases.