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Social Disadvantage and Children's Nutritional Status in Rural-Urban Migrant Households

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ABSTRACT

This article uses an innovative rural-urban migrant survey to assess how social disadvantage is associated with children's nutritional status in migrant households. Measures of social disadvantage are based on China's *hukou* system of household registration (designed to limit domestic migration flows by denying urban public services to migrants with rural registrations) and on son preference (stemming in part from the strict one-child policy). Regression results indicate that a rural *hukou* status is negatively associated with children's weight-for-age Z-scores, even after controlling for household characteristics, and girl children exhibit poorer nutritional status than boys. Results from a quantile decomposition procedure confirm that left-behind children have lower nutritional scores than children who migrate with their parents, and the gaps are biggest at lower portions of the distribution.

Introduction

Global trends point to substantial improvements in children's nutritional status. Between 1990 and 2016, the global incidence of stunting and underweight among young children both declined considerably, from 40 to 23% for stunting and 25 to 14% for underweight. By 2016, the incidence of wasting among young children was even lower, at 8%.[1] China's record in reducing child malnutrition is consistent with these global patterns, due in large part to rapid economic growth in recent decades. Between 1990 and 2010, the incidence of children being underweight dropped by 74% and the incidence of stunting (an indicator of low height for age resulting from chronic nutritional deprivation) fell by 70%.[2] However, progress has remained uneven and millions of children are still at risk for long-term consequences of inadequate food intake. The most recent available data as of 2017 indicate that 9.4% of China's children are still stunted and 3.4% are still underweight, with rural rates about three to four times higher than urban rates.[3] Rapid GDP growth has been insufficient to remove all barriers to better health and nutrition.

In an important collaborative study between Peking University, the University of Chicago, and the Chapin Hall research and policy center, researchers identified two major cultural and political challenges to child development in China: the *hukou* system and the one child policy.[4] The *hukou* is an institutionalized system of social disadvantage that the government has used in an effort to

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[1]UNICEF, *Levels and Trends in Child Malnutrition* (New York: UNICEF, 2017), available at: https://data.unicef.org/topic/nutrition/malnutrition. (accessed 8 March 2018). This source does not report historical data on global wasting.
[2]UNICEF, *Levels and Trends in Child Malnutrition*.
[3]UNICEF, *Levels and Trends in Child Malnutrition*.
[4]Lijun Chen, Dali Yang, and Qiang Ren, *Report on the State of Children in China* (Chicago: Chapin Hall at the University of Chicago, 2015).

control the enormous flow of rural to urban migration (estimated at 245 million people in 2016 by National Bureau of Statistics of China). This household registration system is based on either a rural or an urban classification that depends mostly on birthplace of the household head, and it is very difficult to change. Many public services in urban areas are restricted to individuals with urban *hukou*, thus excluding most rural-to-urban migrants who still have their rural *hukou*. The second challenge—the one child policy—has been linked to dwindling child populations in rural areas and to strong son preference. Chen used descriptive statistics based on microdata from the 2010 China Family Panel Studies to show that both these institutional challenges contribute to large disparities between rural and urban areas in child development and health.[5] However, because the article did not use regression analysis to control for other determinants of children's well-being, it is difficult to pinpoint the extent to which children are penalized by this discriminatory institutional climate.

This article fills this gap by using an innovative dataset and multivariable regression analysis to examine how China's institutionalized forms of social and economic disadvantage impact the nutritional status of children. The authors are especially interested in the nutritional status of children in rural-urban migrant households—both children who migrate with their parents and children who are left behind. In 2010, approximately 61 million children ages 0–17 were left behind in rural villages, accounting for 38% and 22% of all rural children and all children nationally, respectively.[6] The number of left-behind children has been increasing rapidly, with, for example, an increase of 2.42 million children from 2005 to 2010.

This analysis utilizes data from the Migrant Household Survey of the Longitudinal Survey on Rural-Urban Migration in China (RUMiC), a rich dataset on migrant workers and their households that has detailed information on human capital indicators, socioeconomic status, food expenditures, and health. The data are used to examine the determinants of children's nutritional status, as measured by weight-for-age Z-scores (WAZ scores) and height-for-age Z-scores (HAZ scores). This article focuses on four dimensions of social and economic disadvantage that could serve as challenges to children in migrant households: (1) children in migrant households that fail to obtain an urban *hukou* compared to children in migrant households with an urban *hukou*; (2) children in female-headed households as opposed to children in male-headed households; (3) girl children as opposed to boy children; and (4) children who are left behind in rural villages in the care of others as opposed to children who migrate to urban areas with their parents. A battery of tests is used to clearly identify the links between social disadvantage and children's nutritional status, including ordinary least squares regressions and a set of decomposition procedures. To the best of the authors' knowledge, this article is the first to estimate the determinants of nutritional status for children in migrant households and to compare the outcomes for migrating children with left-behind children.

Background: disadvantage and inequality in China

The *hukou* system evolved gradually after the Communist revolution as the government tried to control the flow of rural-to-urban migrants. Despite these efforts, rural-to-urban migration has surged, with some estimates that half of China's population now lives in urban areas, up from just one-fifth in the early 1980s. The majority of these urban migrants do not hold urban *hukou*, and upward mobility from rural-to-urban status is notoriously difficult. A growing body of research indicates that China's urban migrants with a rural *hukou* are at considerable risk of being socially and economically disadvantaged in terms of access to jobs, schooling, health care, pensions, and other public services.[7] For example, even though schooling in China is compulsory and free for the

[5]Lijun Chen, Dali Yang, and Qiang Ren, *Report on the State of Children in China*.

[6]China Women's Federation Research Team, 'Zhongguo nongcun liushou ertong chengxiang liudong ertong zhuangkuang yanjiu baogao' ['Research report on left-behind children and rural-urban migrating children'], *Zhongguo Fuyun* [*Chinese Women's Movement*] 6, (2013), pp.30–34.

[7]See, for example, Christian Dreger, Tongshan Wang, and Yanqun Zhang, 'Understanding Chinese consumption: The impact of hukou', *Development and Change* 46(6), (2015), pp.1331–1344; Farzana Afridi, Sherry Xin Li, and Yufei Ren, 'Social identity and inequality: The impact of China's hukou system', *Journal of Public Economics* 123, (2015), pp. 17–29.

first 9 years, public funding for schools is allocated according to the types of *hukou* that children hold and it is not transferable across administrative entities. This feature of public school funding means that local schools in urban areas do not receive additional funds to educate migrant students who hold rural *hukou*. Compounding the problems of the public finance structure embedded in the *hukou* system are constraints imposed by antiquated teacher staffing policies and land use regulations that make it virtually impossible for large cities to meet the ever-growing demand from migrant households for public education.[8] A substantial proportion of migrating children are thus forced to enroll in migrant schools, which began as informal schools to meet the needs of migrants in urban areas and have commonly been perceived as inferior to public schools.

Moreover, migrating children who enroll in migrant schools have lower standardized test scores in Chinese and math relative to students enrolled in public schools.[9] Closely related, school performance among migrating children is substantially worse than that of children of urban residents, just as there is a large difference between rural and urban children.[10] Another problem related to the *hukou* system occurs when young migrants decide to pursue higher education and they must sit for the entrance exam in the province of their *hukou* registration. All students who apply for university must take the *gaokao* exam in the hometown of their *hukou* registration. However, the best universities in the major metropolitan areas have much smaller quotas for candidates who take their entrance exam outside of the city and province where the university is located. The *hukou* system in conjunction with this entrance exam policy thus poses a major barrier for rural migrant students who want to attend the best universities.[11]

Another outcome of the *hukou* system is discrimination in the labor market, where urban migrants who hold rural *hukou* have more difficulty being hired into high-wage formal sector jobs, especially those in state-owned enterprises.[12] To the extent that urban migrants with rural *hukou* are less likely to find high-wage employment, there are strong implications for their ability to send remittances back home, which in turn could impact the well-being of their children left behind. In particular, children living in poverty in China's rural areas are more likely to experience food insecurity and be undernourished compared to children in wealthier households, and that food-insecure children in turn have lower literacy levels in the long term.[13] Discrimination in the labor market can also worsen overall economic status: rural-urban migrants in China who do not have an urban *hukou* have substantially lower socioeconomic status compared to their locally born counterparts and compared to urban-to-urban migrants, where socioeconomic status takes into account not only earnings and occupation, but also access to social insurance and quality housing.[14]

China is also known for its strong cultural preferences for sons, which is reflected in discrimination against girls in decisions about health care, schooling, and feeding. Amartya Sen first drew attention to the 'missing women' problem with evidence of unusually high male to female population ratios in Asia and North Africa.[15] Parental behavior such as withholding health care

[8]Yisu Zhou and Dan Wang, 'Understanding the constraints on the supply of public education to the migrant population in China: Evidence from Shanghai', *Journal of Contemporary China* 25(100), (2016), pp. 563–578.

[9]Yuanyuan Chen and Shuaizhang Feng, 'Access to public schools and the education of migrant children in China', *China Economic Review* 26, (2013), pp. 75–88; Yuanyuan Chen and Shuaizhang Feng, 'Quality of migrant schools in China: Evidence from a longitudinal study in Shanghai,' *Journal of Population Economics* 30(3), (2017), pp. 1007–1034.

[10]Dandan Zhang, Xin Li, and Jinjun Xue, 'Education inequality between rural and urban areas of the people's Republic of China, migrants' children education, and some implications', *Asian Development Review* 32(1), (2015), pp. 196–224.

[11]Nunzio Nazareno Donzuso, '"Equality of opportunities" in education for migrant children in China', *Global Social Welfare* 2(1), (2015), pp. 9–13.

[12]Yang Song, 'What should economists know about the current Chinese hukou system?' *China Economic Review* 29, (2014), pp. 200–212.

[13]Emily Hannum, Jihong Liu, and Edward Frongillo, 'Poverty, food insecurity and nutritional deprivation in rural China: Implications for children's literacy achievement', *International Journal of Educational Development* 34, (2014), pp. 90–97.

[14]Juhua Yang, 'Social exclusion and young rural-urban migrants' integration into a host society in China', *ANNALS of the American Academy of Political and Social Science* 648(1), (2013), pp. 52–69.

[15]Amartya. Sen, 'Women's survival as a development problem', *Bulletin of American Academy of Arts and Sciences* 18(2), (1989), pp. 14–29.

when a girl is sick contributes to the selective neglect of 'unwanted' girls and to their higher chances of nutritional deprivation and even mortality. The absence of social protection institutions for old age, relatively fewer employment opportunities for women, and strict family planning policies can reinforce the lower social value of women and the cultural preference for having sons.[16] Moreover, mothers who migrate within China may be more likely to bring their boys with them while girls are left behind.[17] Hence, young girls in China's migrant households may be more at risk for poorer nutritional status than boys. The lower value of women, in turn, may contribute to relatively greater economic hardship for female-headed households compared to male-headed households that have migrated to China's urban areas if women face discrimination in the labor market and have more trouble finding a well-paying job than their male counterparts. A number of studies have documented persistent gender gaps in pay and employment in China's urban labor markets.[18]

The authors' analysis of the *hukou* system, social disadvantage, and children's nutritional status builds on previous studies that have examined the nutritional status of children left behind in rural hometowns in China after one or both parents migrated to a city. Using data from the China Health and Nutrition Survey, Mu and De Brauw (2015) find that the income effect outweighs any detrimental effect of parental time away from children.[19] In particular, the migration of at least one parent (where the gender of the migrating parent is not specified) is associated with an improvement in weight-for-age among children under the age of five, while there is no statistically significant effect on children's height-for-age. In contrast, Chen (2013) uses the same data to examine the effects of fathers' migration on children's body mass and finds no statistically significant effects.[20] Similarly, Guo et al. (2016) finds no statistically significant effects of parental migration on child health in the rural sector using data from the Research Center for Rural Economy.[21] Meng and Yamauchi (2017) use yet another dataset—the RUMiC survey—and find that as the duration of the absence of mothers increases due to migration, the height-for-age and weight-for-age of rural children ages 15 and below decreases, while the duration of the absence of migrant fathers has a negative and statistically significant effect only on rural children's weight-for-age.[22] Hence, the evidence on whether parental migration boosts or harms nutritional status of children left behind in China's rural areas is inconclusive, and none of these previous studies examine migrating children in urban areas.

Conceptual underpinnings

The effects of parental characteristics such as employment and education on child nutrition commonly accrue through higher socioeconomic status, which in turn operates through a set of 'proximate determinants' of health that directly influence children's nutritional status.[23] The

[16]Monica Das Gupta, Zhenghua Jiang, Bohua Li, Zhenming Xie, Woojin Chung, and Hwa-Ok Bae, 'Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea', *Journal of Development Studies* 40(2), (2003), pp. 153–187.

[17]Rachel Connelly, Kenneth Roberts, and Zhenzhen Zheng, 'The role of children in the migration decisions of rural Chinese women', *Journal of Contemporary China* 21(73), (2012), pp. 93–111.

[18]See, for example, Wei Chi and Bo Li, 'Trends in China's gender employment and pay gap: Estimating gender pay gaps with employment selection', *Journal of Comparative Economics* 42(3), (2014), pp. 708–725; Lin Xiu and Morley Gunderson, 'Occupational segregation and the gender earnings gap in China: Devils in the details', *International Journal of Manpower* 36(5), (2015), pp. 711–732.

[19]Ren Mu and Alan de Brauw, 'Migration and young child nutrition: Evidence from rural China', *Journal of Population Economics* 28(3), (2015), pp. 631–657.

[20]Joyce J. Chen, 'Identifying non-cooperative behavior among spouses: Child outcomes in migrant-sending households', *Journal of Development Economics* 100(1), (2013), pp. 1–18.

[21]Qian Guo, Wenkai Sun, and Yijie Wang, 'Effect of parental migration on children's health in rural China', *Review of Development Economics* 21(4), (2016), pp. 1132–1157.

[22]Xin Meng and Chikako Yamauchi, 'Children of migrants: The cumulative impact of parental migration on children's education and health outcomes in China', *Demography* 54(5), (2017), pp. 1677–1714.

[23]W. Henry Mosley and Lincoln C. Chen, 'An analytical framework for the study of child survival in developing countries', *Population and Development Review* 10, Supplement (1984), pp. 25–45.

proximate determinants include fertility factors, environmental hazards, feeding practices, injury, and utilization of health services. At the household level, income and wealth are linked to child well-being through the effects that purchased goods and services have on the proximate determinants of child nutrition. Employed parents bring income into the household, which allows for greater household expenditures. Greater income and assets directly increase the ability of households to purchase or access clean water, clothing, adequately ventilated housing, fuel for proper cooking, safe storage of food, personal hygiene items, health services, and sufficient quantities of nutritious foods. These proximate determinants serve as the mechanisms by which socioeconomic status affects children's nutritional status.[24] This framework is consistent with previous findings that poor growth status among Asian children—as measured by low birth weight, stunting (low height-for-age), and wasting (low weight-for-height)—is mostly associated with nutritional and health determinants rather than genetic factors.[25]

Parents' participation in the labor market can entail a fundamental tradeoff. The income that parents earn contributes to the household's ability to purchase goods and services that improve children's nutritional status. However, parents' market-based work could reduce the quantity or quality of time spent caring for children, with potentially adverse effects on child well-being. Just like household income, time spent with children also affects the degree to which parents, and especially mothers, can engage in care practices that influence child nutrition. This tradeoff between income from market-based work and time spent away from children can be exacerbated for parents who have migrated to urban areas and left their children behind in rural villages in the care of others. Parental remittances may improve children's nutritional status through the purchase of more nutritious foods and through housing improvements. However, migrant parents are apart from their children and the quality of care from substitute care-providers may be inferior. Migrant parents who bring their children with them also face this tradeoff given the pressure that migrants face to work long hours in paid employment in order to stave off the risk of economic hardship that comes with rural-to-urban migration.

Insufficient food consumption and the lack of a healthy diet for children can result in unwanted weight loss, fatigue, headaches, poor mental health, and frequent illness. Childhood nutrition in turn serves as an important determinant of an individual's health status in adulthood and of his or her likelihood of developing costly and debilitating health conditions. In addition, children's nutritional status is associated with performance in school and years of educational attainment, both of which serve as important predictors of future labor market outcomes. The literature provides strong evidence that relates children's nutritional status to cognitive development, school performance, and future success in the labor market.[26]

Data

To estimate the determinants of nutritional status among children in China's migrant households, the authors use data from the Longitudinal Survey on Rural-Urban Migration in China (RUMiC) for 2008 and 2009. The RUMiC, which was set up to investigate the patterns and effects of migration in China, comprises three independent surveys: the Urban Household Survey (UHS), the Rural Household Survey (RHS), and the Migrant Household Survey (MHS). Each of these surveys contains individual microdata jointly collected by researchers at the Australian National University, the

[24]For a review of evidence on the relationship between household socioeconomic status and child health, see Yana Rodgers, *Maternal Employment and Child Health: Global Issues and Policy Solutions* (Northampton, MA, and London: Edward Elgar Publishing, 2011).

[25]Ray Yip, Kelley Scanlon, and Frederick Trowbridge, 'Improving growth status of Asian refugee children in the United States', *Journal of the American Medical Association* 267(7), (1992), pp. 937–940.

[26]For a review of the literature on long-term effects of children's health, see Janet Currie, 'Healthy, wealthy, and wise: Socioeconomic status, poor health in childhood, and human capital development', *Journal of Economic Literature* 47(1), (2009), pp. 87–122.

University of Queensland, and the Beijing Normal University.[27] This article uses just the MHS, in which migrant workers are defined to be workers with a rural *hukou* who are living in a city at the time of the survey.[28] The survey was taken in cities that are either provincial capitals or other major migrant-receiving cities contained in nine provinces and three regions (Figure 1). The Eastern region contains Guangzhou, Dongguan, Shenzhen, Shanghai, Nanjing, Wuxi, Hangzhou, and Ningbo; the Central region includes Zhengzhou, Hefei, Luoyang, Bengbu, and Wuhan; and the Western region contains the two highly populated cities of Chengdu and Chongqing. The survey contains comprehensive information on a wide array of control variables that can affect measures of children's food consumption and nutritional status.

The sample is restricted to children ages 15 and below who live in households that report household expenditures.[29] After deleting observations with missing values for any of the key variables in the analysis, the pooled dataset contains a total of 3,235 children, of whom 1,429 live with their parents in urban areas and 1,806 are left behind in the rural hometowns. Most missing values occur for children's anthropometric measures because parents are asked the current height and weight of a child and some parents do not know this information. The survey uses a recall method rather than scales for children's height and weight largely because many children in the sample do not live with their parents. Excluding the children with missing values from the sample is unlikely to bias the results in a particular direction.[30] This article defines left-behind children as cases in which both parents or just one (father or mother) have migrated from rural-to-urban areas while leaving the child behind in the rural village to which the household registration (*hukou*) belongs. Among the 61 million left-behind children in 2010, 47% had both parents migrate to cities; 36% had just fathers migrate; and 17% had just mothers migrate. This article uses the same definition.[31] This imbalance between children who migrate with their parents versus those who are left behind is consistent with evidence in Mu and de Brauw (2015) that among Chinese households with urban migrants, migration of entire families is less common so many children are left behind.

Note that the RUMiC migrant survey contains no sample weights. Due to the largely incomplete official residential registration of migrants in cities, the most fundamental challenge of designing an unbiased sampling frame involves how to randomly sample the migrant population when lacking reliable information on the migrants' backgrounds and their distribution. Existing migrant surveys (for example, the China Urban Labour Survey conducted by China Academy of Social Sciences) nevertheless use administrative records of residential addresses as the basis for sampling. However, a large proportion of migrant workers in China live in their workplaces such as factory dormitories and construction sites, so the residential sampling framework is inevitably biased. The RUMiC survey addresses this issue by using a unique sampling frame based on information collected in a census of migrant workers at their workplaces, and the census is conducted in a number of randomly selected city grids within the defined city's boundary.[32]

[27]Data collection was supported by the Institute for the Study of Labor, which provides the Scientific Use Files through its data center. More information about the data can be found in Mehtap Akgüç, Corrado Giulietti, and Klaus F. Zimmermann, 'The RUMiC longitudinal survey: Fostering research on labor markets in China', *IZA Journal of Labor & Development* 3(1), (2014), pp. 1–14.

[28]Note that the data are a panel, and some individuals were able to change their *hukou* status during the period for reasons discussed below.

[29]The authors conducted a series of robustness checks with children ages 0–12 and found the results to be qualitatively consistent.

[30]This recall method is less accurate than using scales. However, surveyors are affiliated with the National Bureau of Statistics of China and are highly experienced, which could help to minimize measurement error.

[31]In the RUMiC surveys, the authors are able to distinguish between migrating children who live with parents in the household and those who are left behind from the questions "Where is the current primary residential place of the child located?" and "Where did the child reside in 2007 (or 2008)?".

[32]IZA Institute of Labor Economics, Australian National University, University of Queensland, and Beijing Normal University. Longitudinal Survey on Rural Urban Migration in China (RUMiC) 2008–2009. International Data Service Center of IZA (IDSC). Version 1.0. https://doi.org/10.15185/izadp.7680.1, (2014) (accessed 5 January 2017). Further details regarding the listing scheme and random sampling procedures of the survey can be found in Sherry Tao Kong, 'Rural-urban migration in China: Survey design and implementation', in Xin Meng, Chris Manning, Li Shi, and Tadjuddin Noer Effend, eds., *The Great Migration: Rural-Urban Migration in China and Indonesia* (New York, Edward Elgar Publishing, 2010), pp. 135–150.

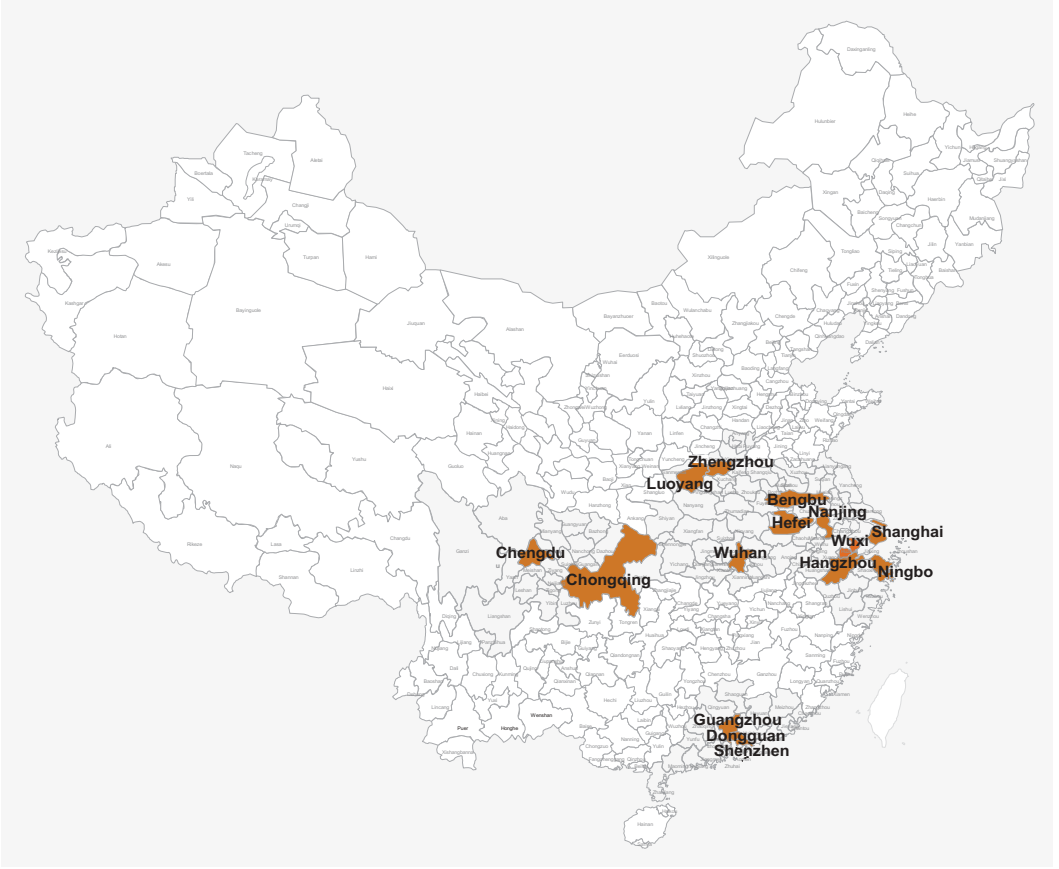

Figure 1. Spatial coverage of the urban migrant survey in RUMiC data.

Note: The survey covers 15 cities as indicated by the dark areas on the map – Bengbu, Chengdu, Chongqing, Dongguan, Guangzhou, Hefei, Hangzhou, Luoyang, Nanjing, Ningbo, Shanghai, Shenzhen, Wuhan, Wuxi, and, Zhengzhou. They are either provincial capital cities or other major migrant receiving cities.

This article uses data in the RUMiC on children's height and weight to specify children's nutritional status as height-for-age and weight-for-age Z-scores (standard deviation scores). These measures compare each child to a reference population. For population-based assessment, the Z-score is routinely considered to be the best system for analysis of anthropometric data and the best indicator of malnutrition. The *Z*-score specifies the relevant anthropometric value as a number of standard deviations above or below the reference median of the US Centers for Disease Control Reference Population for children of the same gender.[33] The formula for calculating the *Z*-score is: *Z*-score = (observed value—median value of the reference population)/standard deviation of the reference population by gender. Note that the authors did not perform estimations for weight-for-height or weight-for-length Z-scores (common measures of short-term nutritional deprivation) because the sample size drops by about one-third. The reference populations for weight-for-height and weight-for-length are usually restricted by weight and height, so a *Z*-score is set to missing if a child's weight or height/length falls outside of the range. For example, the reference group for WHZ scores is based on the range of 77cm to 121.5cm, so any child who is above or below this range is dropped from the sample. These children are not dropped from the WAZ sample because the reference group is based on age benchmarks (ages 0–20), so even very small and very tall children are kept in the sample.

[33]Centers for Disease Control and Prevention (CDC), *Clinical Control Charts* (Atlanta, GA: CDC, 2000).

Note that the CDC growth charts were used as a standard rather than the World Health Organization (WHO) growth charts because the CDC comparison group is a more appropriate reference group given the sample of younger and older children. As argued in Meng and Yamauchi's (2017) analysis of children's nutritional status in China, the WHO growth charts are based on two sets of standards: the first reference group (for younger children ages 0–5) consists of children raised with ideal health practices, and the second reference group (for older children ages 5–19) is based on a set of US children's growth charts from 1977. The CDC comparison group avoids this methodological break at age 5 and is based on more recent growth charts. All that being said, the regression results are similar in substance when the WHO standards are used.

Sample means, presented in Table 1, indicate that on average, children from migrant families who live with their parents have higher WAZ and HAZ scores than their counterparts who are left behind. Among the control variables, the sample means indicate that a very small percentage of children in migrant households have an urban *hukou* (3%), and this figure is even lower for children who are left behind in rural villages. This small proportion is consistent with the number reported by Chen.[34] It is possible for rural-urban migrant households to obtain urban *hukou* in cases when the household head has a specialized secondary or tertiary education, is a member of the Chinese Communist Party, or has military experience.[35] In addition, some households have had their rural *hukou* status changed to urban when the government has expropriated their land.[36] Table 1 also indicates that more than a quarter of migrating children are in female-headed households, and this proportion is even higher for children living with their parents. Note that the RUMiC survey defines the household head as the major contributor to the household income or the decision-maker in the household. If the respondent is unable to designate the household head based on these criteria, they can designate the head as the person who is most familiar with the household situation.

Fewer than half of the children are girls, and for the final key indicator of disadvantage, about 56% of children in migrant households are left behind in rural villages. Of particular interest among the other control variables is the food share in total consumption spending: on average, migrating children live in households that spend between 3 and 4% of their total consumption budgets on food. Further, the average weekly hours of work by the household head, which is considerably higher for the parents of children left behind (35) compared to the parents who still live with their children (30). Consistent with published statistics on gender gaps in schooling, on average, mothers have about 2 years less schooling than fathers, a gap that is larger for the parents of left-behind children and smaller for parents who live with their children. Consistent with published statistics, most household heads identify their ethnicity as Han, the dominant ethnic group in China.

Looking more closely at the differences in anthropometric measures between children of migrant families who live with their parents and those who are left behind, Figure 2 depicts kernel density estimates for the weight-for-age and height-for-age Z-scores. Each curve shows the distribution of Z-scores around zero (where the observed value for a particular child equals the median value for the reference group). Both panels in Figure 2 depict weighted kernel densities using standard bandwidths that are selected non-parametrically. Panel A shows that the WAZ distribution for children left behind is generally to the left of the distribution for children living with their parents, indicating that left-behind children are at greater risk of nutritional deprivation as measured by their weight-for-age. The difference in the two distributions is even larger for the HAZ distributions. Since height-for-age is considered a longer term measure of nutritional deprivation, the figure suggests that migration decisions that entail leaving children behind can have long-lasting negative repercussions for the children's nutritional status.

[34]Lijun Chen, Dali Yang, and Qian Ren, *Report on the State of Children in China.*

[35]Xiaogang Wu and Donald J. Treiman, 'The household registration system and social stratification in China: 1955–1996', *Demography* 41(2), (2004), pp. 363–384.

[36]Mehtap Akgüç, Xingfei Liu, and Massimiliano Tani, 'Expropriation with hukou change: Evidence from a quasi-natural experiment', IZA working paper no. 8689 (2014).

Table 1. Sample statistics

	All Children		Left-Behind Children		Children with Parents	
Characteristics	Mean	S.D.	Mean	S.D.	Mean.	S.D.
Outcome variables						
Weight-for-Age Z-score (WAZ)	.254	1.523	.160	1.568	.372	1.455
Height-for-Age Z-score (HAZ)	−.535	1.883	−.797	1.882	−.205	1.831
Key indicators of disadvantage						
Household has rural *hukou*	.973	.162	.997	.058	.943	.231
Female-headed household	.288	.453	.269	.444	.311	.463
Child is a girl	.433	.496	.431	.495	.435	.496
Child left behind	.558	.497	1.000	.000	.000	.000
Household level controls						
Occupational rank HH head	14.088	6.418	13.477	6.391	14.860	6.371
Bottom consumption quartile	.216	.411	.349	.477	.048	.213
2nd consumption quartile	.240	.427	.271	.445	.199	.400
3rd consumption quartile	.271	.444	.236	.425	.315	.465
Top consumption quartile	.274	.446	.144	.351	.438	.496
Food share in total consumption	3.445	1.428	3.657	1.530	3.178	1.236
Usual weekly hours worked HH head	32.793	36.103	34.977	35.087	30.033	37.176
Mother's years of education	6.141	4.055	5.148	4.376	7.397	3.197
Father's years of education	7.977	3.370	7.572	3.690	8.490	2.835
Age of HH head	35.023	5.200	34.907	5.120	35.169	5.297
HH head has Han ethnicity	.982	.134	.986	.119	.977	.150
Height of HH head (cm)	166.697	6.872	166.793	6.823	166.576	6.934
Village/Rural hometown information						
Distance between hometown and the nearest bus station (km)	14.518	22.891	13.813	21.328	15.410	24.704
Distance between hometown and the nearest primary school (km)	1.961	4.319	1.844	3.779	2.109	4.915
Distance between hometown and the nearest junior high school (km)	4.466	7.516	4.549	7.414	4.361	7.644
Hometown has health clinic	.894	.308	.895	.307	.893	.309
City level controls						
GDP per capita (log)	7.990	.970	8.133	.919	7.809	1.003
Number of hospitals	242.69	223.89	258.65	228.95	222.52	215.71
Number of doctors (thous.)	18.281	10.504	19.412	10.406	16.848	10.456
Number of employed workers (thous.)	2901.1	1709.8	3112.7	1776.0	2633.7	1582.9
No. observations	3,235		1,806		1,429	

Note: Sample includes children under the age of 16 years.

Empirical methodology

OLS regressions with fixed effects

This article starts the empirical analysis with a fixed-effects regression analysis of the determinants of children's nutritional status. The estimation equation is specified as follows:

$$Y_{ijt} = b_1 D_{ijt} + b_2 X_{ijt} + b_3 J_j + b_4 T_t + e_{ijt} \quad (1)$$

The notation Y_{ijt} denotes the nutritional status of child i in region j in year t, alternatively measured as weight-for-age Z-scores and height-for-age Z-scores; the variable D is an indicator of social disadvantage, alternatively measured by whether or not the household has a rural *hukou*, whether or not the household has a female household head, whether or not the child is a girl, and whether or not the child lives with their parents. The matrix X represents household-level controls, including the prestige ranking of the household head's primary occupation, a set of dummy variables for consumption expenditure quartiles, the share of food expenditures in total consumption expenditures, the usual weekly hours worked by the household head, mother's years of schooling, father's years of schooling, age of the household head, a dummy variable for household head is of the Han ethnic group (the dominant ethnic group in China), and height of the household head. Note that the occupational prestige variable is a ranking from 0 to 25 (from lowest to highest prestige) for the 25 occupation

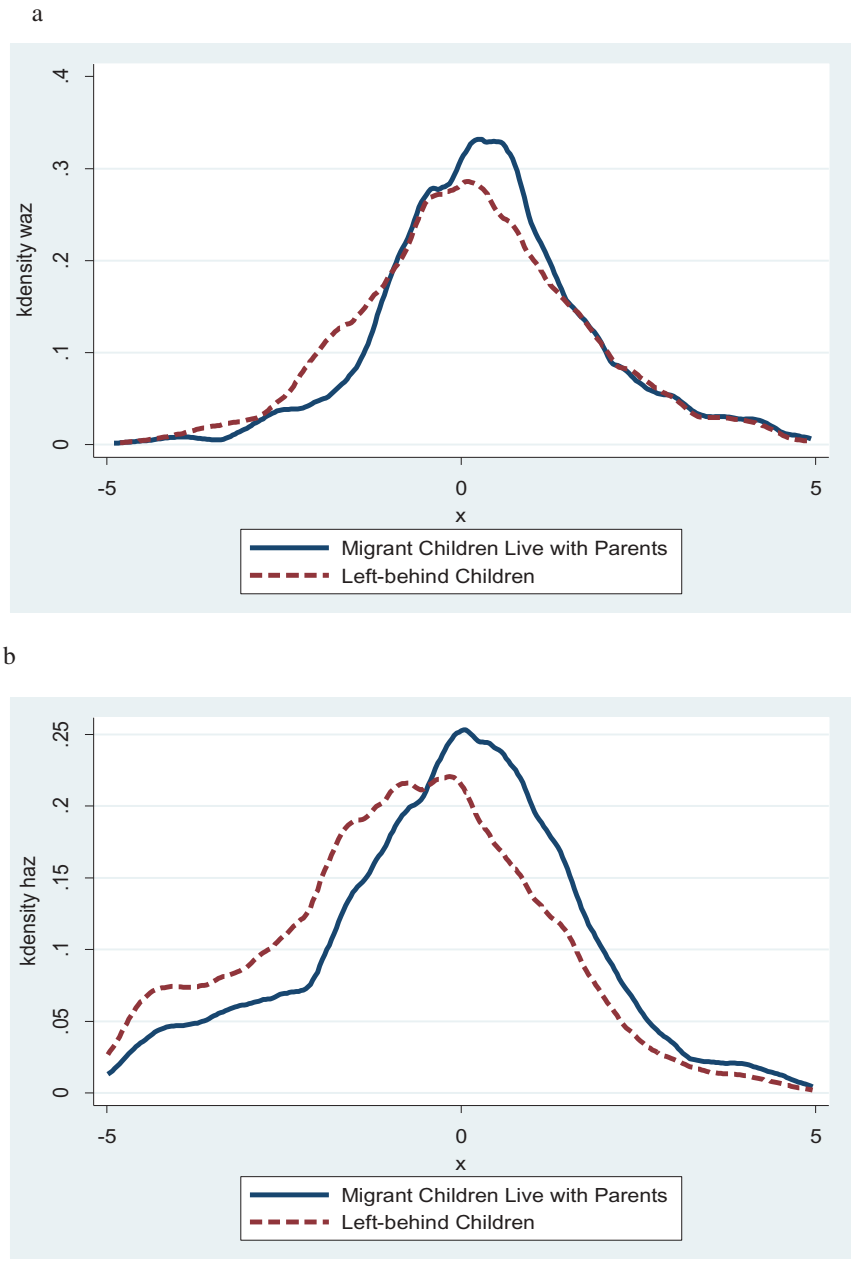

Figure 2. Kernel density estimates of child anthropometric measures. Panel a: weight-for-age Z-scores. Panel b: height for age Z-scores.

categories in the RUMiC data based on the occupational prestige scores in Li (2005).[37] Depending on specifications, the matrix *X* also includes village-level and city-level characteristics. The village-level controls measure public facility accessibility in the villages where the parents migrated from, including distance to the nearest primary school, junior high school, and bus station, and whether or not the

[37]Chunling Li, 'Dandai Zhongguo Shehui de Shengwang Fencing—Zhiye Shenwang yu Shehui Jingji di wei zhi shu celiang' ['Prestige stratification in the contemporary China: Occupational prestige measures and socio-economic index'], *Sheguixue yanjiu* [*Sociological Research*] 2, (2005), pp. 74–102.

hometown has a health clinic. The city-level controls measure economic conditions in the cities where the migrant households currently live, including GDP per capita and the number of hospitals, doctors, and employed workers.[38]

Also in the Equation, the notation *J* represents region-level fixed effects, and *T* denotes year fixed effects.[39] The equation is estimated for all children in migrant families as well as separately for children living with their parents and children left behind. Because the survey records multiple children per household as separate observations, the authors correct the standard errors for clustering at the level of the household.

Oaxaca decomposition, quantile regressions, and quantile gap decompositions

In the next part of the analysis, for both indicators of nutritional status, the gap between left-behind children and children who migrate with their parents is decomposed into an explained portion and an unexplained portion. Specifically, using a fairly standard application of the Oaxaca-Blinder procedure, the authors decompose the WAZ score gap Δ (and alternatively the HAZ score gap) between left-behind children and children who migrate with their parents into a portion explained by average group differences in observed characteristics and a residual portion that is unexplained.[40] This decomposition is expressed in vector-matrix form as

$$\begin{aligned}\Delta_t &= \overline{\mathbf{Y}}_t^{LB} - \overline{\mathbf{Y}}_t^{MC} = \overline{\mathbf{X}}_t^{LB}\mathbf{b}_t^{LB} - \overline{\mathbf{X}}_t^{MC}\mathbf{b}_t^{MC} \\ &= \underbrace{(\overline{\mathbf{X}}_t^{LB} - \overline{\mathbf{X}}_t^{MC})\mathbf{b}_t^{LB}}_{\substack{\text{explained gap} \\ \text{(characteristics effect)}}} + \underbrace{(\mathbf{b}_t^{MC} - \mathbf{b}_t^{LB})\overline{\mathbf{X}}_t^{MC}}_{\substack{\text{unexplained gap} \\ \text{(coefficient effect)}}}\end{aligned} \tag{2}$$

where the bar denotes the sample average, *t* is the year, and the superscripts LB and MC denote left-behind children and migrating children who live with their parents. The explained gap is the portion of the gap attributed to differences between the two groups of children in observed characteristics as measured by the control variables in Equation, and the unexplained gap is the portion attributed to differences in the coefficients on those variables. To perform a similar decomposition at different quantiles of the WAZ score and HAZ score distributions, the authors utilized an unconditional quantile regression technique.[41] Using this technique, the authors trace the entire distribution of WAZ scores and HAZ scores by steadily increasing the percentile in increments of 10 from 0 to 100. Intuitively, the unconditional quantile regression for the mean is just a standard OLS regression, and the decomposition at the mean is a conventional Oaxaca decomposition. The estimated coefficients in the quantile regressions are interpreted as effects of the independent variables on the unconditional quantiles.

Results and discussion

Fixed-effects results

Table 2 reports the fixed-effects estimates for the determinants of the child anthropometric measures that include the four indicators of social disadvantage, as well as a full set of socioeconomic status variables and household characteristics. One of the most striking results is that even after controlling for

[38]City level characteristics are measured with data from National Bureau of Statistics of China, China Statistical Yearbook (Beijing: China Statistics Press, various years).

[39]The authors also ran models with fixed effects at the province level and the results are very similar.

[40]Ronald Oaxaca, 'Male-female differentials in urban labor markets', *International Economic Review* 14(3), (1973), pp. 693–709; Alan Blinder, 'Wage discrimination: Reduced form and structural estimates', *Journal of Human Resources* 8(4), (1973), pp. 436–455.

[41]Sergio Firpo, Nicole Fortin, and Thomas Lemieux, 'Unconditional quantile regressions', *Econometrica* 77(3), (2009), pp. 953–973; Nicole Fortin, Thomas Lemieux, and Sergio Firpo, 'Decomposition methods in economics', *Handbook of Labor Economics* 4, (2011), pp. 1–102.

the full set of SES variables and household characteristics, the rural *hukou* variable has a negative and statistically significant relationship with migrating children's weight-for-age Z-scores. In particular, children in migrant families who still have a rural *hukou* have WAZ scores that are, on average, 0.33 points lower than children in migrant families who have an urban *hukou*. This coefficient is not only statistically significant, but it is also relatively large in magnitude. The second column of results shows that most of this estimate is coming from children who continue to live with their parents. The rural *hukou* does not appear to matter as much for children who are left behind, most likely because there is very little variation across rural households in this variable. A very small proportion of left-behind children in rural hometowns do have an urban *hukou* though, which is possible if the parents had been able to successfully acquire an urban *hukou* and if some unforeseen event (such as a family emergency or sickness) caused the child to have to return to the rural hometown. The only coefficient estimate that is larger in magnitude is for Han ethnicity. The estimates show that children from families where household heads are members of the majority Han ethnicity have a WAZ score that is, on average, 0.45 points lower than their ethnic minority counterparts, with most of this effect coming from children who are left behind.

For the next indicator of social disadvantage—female-headed household—children from female-headed households do not appear to experience any drawback in terms of their WAZ scores as originally hypothesized. The first three columns show that female headship has a fairly small and statistically insignificant association with children's weight-for-age Z-scores. This result may arise from the counteracting effect of mothers tending to spend higher proportions of additional resources on investments in children's human capital compared to fathers. Although improvements in household income may benefit all members, resources concentrated in the hands of women may do more for children than those concentrated in the hands of men.[42] Women's control over financial resources has well-documented effects on human-capital outcomes for themselves and their children through cooperatively bargained processes. These beneficial effects may be dominating any negative effects that women experience from gender discrimination in the labor market.

Although the authors do not see an association when it comes to the sex of the household head and children's WAZ scores, the authors do see a penalty for girl children: on average, a girl has a WAZ score that is 0.20 points lower compared to a boy—a penalty that is about the same for children living with their parents and children who are left behind. Because these Z-scores are constructed from reference population averages that are gender-specific, the lower WAZ scores do not reflect physiological norms in which boys weigh more than girls. Rather, girls are exhibiting lower WAZ scores for some other reason that could be related to China's traditional practices and views around son preference.

The fourth indicator of social disadvantage is whether or not children from migrant families are left behind in their rural villages or live with their parents in urban areas. Not surprisingly, results in Table 2 indicate a substantial penalty for being left behind as opposed to living with one's parents. Children from migrant families who are left behind in the care of other family members or friends in rural areas have WAZ scores that are 0.18 points lower than children who migrate with their parents to urban areas.

Several of the control variables have a negative and statistically significant relationship with children's WAZ scores. In particular, children whose parents work longer hours tend to have lower WAZ scores. This result reflects the tradeoff associated with market-based work: time spent by parents working in the labor market contributes to household income, but takes away from time spent caring for children, which could have a deleterious effect on their nutritional status. Age of the household head also has a negative and statistically significant association with children's WAZ scores. Counteracting these detrimental influences are positive relationships between children's

[42]Agnes R. Quisumbing and John Maluccio, 'Resources at marriage and intrahousehold allocation: Evidence from Bangladesh, Ethiopia, Indonesia and South Africa', *Oxford Bulletin of Economics and Statistics* 65(3), (2003), pp. 283–327; Duncan Thomas, 'Incomes, expenditures, and health outcomes: Evidence on intrahousehold resource allocation', in Lawrence Haddad, John Hoddinott, and Harold Alderman, eds., *Intrahousehold Resource Allocation in Developing Countries*. (Washington, DC: IFPRI, 1997), pp. 142–164.

Table 2. Fixed effects estimates for determinants of child anthropometric measures

	Weight-for-Age Z-scores			Height-for-Age Z-scores		
	All Children	Children with Parents	Left-Behind Children	All Children	Children with Parents	Left-Behind Children
Social disadvantage indicators						
Rural *hukou*	−.334**	−.313*	−.108	−.208	−.218	−.088
	(.158)	(.167)	(.316)	(.228)	(.238)	(.549)
Female-headed HH	.108	.085	.191	.591***	.629***	.583***
	(.100)	(.140)	(.148)	(.126)	(.179)	(.182)
Child is a girl	−.202***	−.184**	−.222***	−.102	−.181*	−.033
	(.054)	(.078)	(.073)	(.071)	(.106)	(.095)
Child left behind	−.184***			−.322***		
	(.067)			(.088)		
Household level controls						
Occup. rank of HH head	.009*	.012**	.003	−.005	−.001	−.003
	(.004)	(.006)	(.006)	(.005)	(.008)	(.008)
2nd consumption quartile	.058	.002	.074	.051	.661*	−.056
	(.087)	(.243)	(.099)	(.115)	(.369)	(.124)
3rd consumption quartile	.017	.044	−.034	.165	.691*	.092
	(.092)	(.240)	(.109)	(.124)	(.367)	(.139)
Top consumption quartile	−.105	−.121	−.044	.139	.650*	.140
	(.099)	(.238)	(.135)	(.136)	(.365)	(.176)
Food share in consumption	.016	.044	.002	−.005	.044	−.035
	(.020)	(.035)	(.025)	(.026)	(.044)	(.032)
Usual hours worked (week)	−.007***	−.007***	−.006**	−.001	.001	−.002
	(.002)	(.003)	(.003)	(.002)	(.003)	(.003)
Mother's years of education	.018**	.032**	.012	.041***	.062***	.034**
	(.009)	(.015)	(.011)	(.011)	(.019)	(.014)
Father's years of education	.007	−.005	.009	.006	−.005	.004
	(.009)	(.015)	(.013)	(.012)	(.021)	(.016)
Age of HH head	−.069***	−.069***	−.066***	.008	.003	.012
	(.006)	(.008)	(.009)	(.007)	(.011)	(.010)
HH head has Han ethnicity	−.452**	−.305	−.581**	−.126	−.387*	.122
	(.176)	(.216)	(.271)	(.268)	(.230)	(.479)
Height of HH head	.024***	.024***	.025***	.035***	.036***	.036***
	(.006)	(.009)	(.009)	(.008)	(.012)	(.010)
Village level controls	Yes	Yes	Yes	Yes	Yes	Yes
City level controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.099	.126	.087	.059	.046	.034
No. observations	3,235	1,429	1,806	3,235	1,429	1,806

Note: Standard errors, in parentheses, are clustered at the household level. The notation *** is $p < 0.01$, ** is $p < 0.05$, * is $p < 0.10$. All regressions include regional and year fixed effects. Children are under the age of 16.

WAZ scores and the occupational prestige ranking of the household head, mother's schooling, and height of the household head. The positive and statistically significant coefficient of mother's schooling on children's weight-for-age scores is consistent with findings in numerous studies for China and other countries that maternal education is an important positive determinant of children's nutritional status.[43]

An interesting question is whether or not the detrimental effects of the measures of social disadvantage hold for HAZ scores. Children with very low HAZ scores are considered to be stunted, an indicator of long-term nutritional status, capturing the effects of chronic nutritional deprivation or chronic or recurrent illness. One might expect children in migrant households to experience longer term nutritional deprivation if their parents fail to find adequate work or the separation from their children persists. Results in Table 2 support this argument when social disadvantage is

[43]Michale Boyle, Yvonne Racine, Katholiki Georgiades, Dana Snelling, Sungjin Hong, Walter Omariba, Patricia Hurley, and Purnima Rao-Melacini, 'The influence of economic development level, household wealth and maternal education on child health in the developing world', *Social Science & Medicine* 63(8), (2006), pp. 2242–2254; Yuyu Chen and Hongbin Li, 'Mother's education and child health: Is there a nurturing effect?' *Journal of Health Economics* 28(2), (2009), pp. 413–426.

measured as the child being left behind, but not for rural *hukou* status. That is, holding a rural *hukou* no longer appears to be relevant for children's HAZ scores. Thus, this article concludes that children pay a cost in terms of nutritional status in the short term if their parents fail to obtain an urban *hukou*, but in the long term the households are resilient and children do not suffer a penalty as measured by lower HAZ scores. In contrast, this long-term resiliency argument does not appear to hold for girl children or for left-behind children. Girl children still experience a penalty in their HAZ scores relative to boys, although the result is only statistically significant for the sample of children who live with their parents. Another similar conclusion for WAZ and HAZ scores is that children who are left behind experience a substantial penalty as compared to children who live with their parents, with a HAZ score differential of 0.32 points.[44]

Also an important factor for children's HAZ scores is household headship. Children in migrant families headed by a woman have, on average, a height-for-age Z-score that is 0.59 points higher than children from migrant families with male household heads. This coefficient is large and statistically significant at the 1% level, and this association holds for the sub-samples of children living with their parents and children left behind. Most likely, this result reflects previous findings in the literature that on the margin, financial resources in the hands of women have a larger impact on children's health and household budget allocations toward child investments as compared to financial resources in the hands of men. Closely related is the argument that household headship proxies for differences in nurturing patterns, and even though female-headed households on average may have lower incomes than male-headed households, women's nurturing behaviors help to explain why children in female-headed households are better nourished.[45] Finally, also common across the results for WAZ and HAZ scores is the positive associations with maternal education and with height of the household head.

Results of Oaxaca and quantile decomposition of WAZ and HAZ gaps

The next stage of the analysis entailed Oaxaca and quantile decompositions of the gap in WAZ and HAZ scores between left-behind children and children who live with their parents. Table 3 reports these gaps as the score for left-behind children minus the score for children living with their parents. The table indicates that at the mean and at all percentiles of the WAZ and HAZ distributions, children who live with their parents have higher WAZ and HAZ scores than children left behind. These group differences are statistically significant at all percentiles except for the WAZ scores in the top half of the distribution. At the mean, most of the WAZ gap is explained by differences in coefficients (61%), while most of the HAZ gap is explained by differences in characteristics (62%). This result implies that steps taken to improve the socioeconomic status of migrant households (as measured by the variables included is the matrix of observed characteristics) will do more to close the nutritional status gap in the long term (as indicated by HAZ scores) than in the short term (as indicated by WAZ scores).

Looking more closely at the quantile decomposition results for the WAZ scores, Table 3 shows that the total WAZ gaps become smaller as one moves up along the distribution. This closing of the gap occurs primarily due to smaller explained gaps between the two groups of children, as indicated by the column of results for gaps due to characteristics (1) Intuitively, left-behind children

[44]It is possible that this result suffers from endogeneity bias in the parental decision to migrate. That is, parents may decide to migrate because they are desperate to earn extra money to care for children who have been suffering from chronic nutritional deprivation and have very low HAZ scores. The authors estimated a preliminary set of instrumental variables (IV) regressions to address this potential endogeneity bias and found that the OLS result for the negative effect of being left behind on HAZ scores is consistent with results from the IV approach.

[45]Eileen Kennedy and Lawrence Haddad, 'Are pre-Schoolers from female-headed households less malnourished? A comparative analysis of results from Ghana and Kenya,' *Journal of Development Studies* 30(3), (1994), pp. 680–695. Another explanation is that mothers in co-resident households where the husband is the head may be negatively selected in some unobserved way. However, it is difficult to test for this possibility and there is very little if any evidence from other countries to help gauge the likelihood of this kind of selectivity bias being an issue.

Table 3. Mean and quantile decompositions of differences in WAZ and HAZ distributions between left-behind children and children who live with their parents

	Weight-for-Age Z scores (WAZ)			Height-for-Age Z scores (HAZ)		
		Due to			Due to	
Mean/ Quantile(τ)	Raw difference	(1) Characteristics	(2) Coefficients	Raw difference	(1) Characteristics	(2) Coefficients
Mean	−.211***	−.083**	−.128***	−.592***	−.367***	−.225***
	(.053)	(.033)	(.043)	(.066)	(.038)	(.055)
	[100]	[39.34]	[60.66]	[100]	[61.99]	[38.01]
.10	−.536***	−.240***	−.296***	−.564***	−.521***	−.043
	(.089)	(.050)	(.073)	(.150)	(.084)	(.125)
	[100]	[44.71]	[55.29]	[100]	[92.37]	[7.63]
.20	−.362***	−.136***	−.226***	−.801***	−.509***	−.292***
	(.114)	(.041)	(.058)	(.114)	(.066)	(.095)
	[100]	[37.52]	[62.48]	[100]	[63.55]	[36.45]
.30	−.365***	−.155***	−.211***	−.663***	−.430***	−.233***
	(.064)	(.038)	(.052)	(.093)	(.053)	(.077)
	[100]	[42.34]	[57.66]	[100]	[64.85]	[35.15]
.40	−.172***	−.082**	−.090*	−.773***	−.470***	−.303***
	(.059)	(.036)	(.048)	(.084)	(.049)	(.069)
	[100]	[47.74]	[52.26]	[100]	[60.81]	[39.19]
.50	−.280***	−.113***	−.167***	−.582***	−.394***	−.188***
	(.058)	(.036)	(.047)	(.077)	(.046)	(.063)
	[100]	[40.22]	[59.78]	[100]	[67.76]	[32.24]
.60	−.066	−.039	−.027	−.558***	−.318***	−.240***
	(.059)	(.037)	(.048)	(.075)	(.044)	(.062)
	[100]	[58.83]	[41.17]	[100]	[56.96]	[43.04]
.70	−.054	−.032	−.023	−.549***	−.297***	−.252***
	(.069)	(.042)	(.056)	(.080)	(.047)	(.066)
	[100]	[58.36]	[41.64]	[100]	[54.04]	[45.96]
.80	−.008	−.027	.020	−.339***	−.225***	−.114
	(.089)	(.053)	(.073)	(.087)	(.052)	(.074)
	[100]	[359.79]	[−259.79]	[100]	[66.35]	[33.65]
.90	−.011	.077	−.088	−.366***	−.245***	−.122
	(.123)	(.072)	(.102)	(.101)	(.055)	(.089)
	[100]	[−707.74]	[807.74]	[100]	[66.75]	[33.25]

Note: Robust standard errors in parenthesis. Shares of contribution to the raw difference in brackets. Number of quantile regressions estimated is 300. Total number of observations is 3235, whereas the numbers of observations in group 0 (migrating children live with parents) and in group 1 (left-behind children) are 1429 and 1806, respectively. The notation *** is $p < 0.01$.

who are higher up the distribution of WAZ scores suffer less of a penalty from relative deficiencies in household characteristics. In the case of HAZ scores, Table 3 shows that while the total gap does get smaller as the percentiles increase, changes in the size of the explained gap and the unexplained gap do not always move in the same direction. While the explained gap (the portion due to observed characteristics) shrinks as one moves across higher percentiles of the distribution, the size of the unexplained gap (the portion due to coefficients) fluctuates across the distribution. Hence, left-behind children in higher percentiles of the HAZ-score distribution are experiencing smaller overall gaps relative to children who live with their parents, and this relative improvement occurs due to their observed household characteristics, as well as the returns to those characteristics.

Policy lessons

This article, the first to examine China's rural-urban migrant households and the nutritional status of both children left behind as well as children who migrate with their parents, has found that China's institutionalized form of trying to limit migrant flows has a detrimental impact on the nutritional status of children. In particular, the *hukou* system of household registration—in which many public social services in China's cities are accessible only to residents with an urban household registration—has a negative and

statistically significant association with children's weight-for-age Z-scores, even after controlling for a full set of socioeconomic status indicators and household characteristics. This indicator is a measure of shorter-term nutritional deprivation in which children are deprived of sufficient calories to exhibit substantial weight loss relative to the benchmark reference group. This relative deprivation for children whose parents do not hold an urban *hukou* is exhibited mostly for children who migrate with their parents; the result is not precisely estimated for children who are left behind. The urban *hukou* does not appear to have a relationship with height-for-age Z-scores—an indicator of longer-term nutritional status—after controlling for household socioeconomic status and composition, suggesting that rural-urban households are resilient in the longer term and are able to adjust to their new urban lives without their children exhibiting more permanent signs of reduced height due to insufficient caloric intake.

This article also found substantial penalties for WAZ and HAZ scores among children who are left behind in rural villages in the care of others, relative to children who migrate with their parents. These penalties are particularly large for children at lower ends of the WAZ and HAZ percentile distributions. Finally, in the tests for penalties arising from gender, the authors found that children in female-headed households do not appear to suffer from any nutritional deprivation relative to children in households headed by men as originally hypothesized. However, girl children do exhibit lower HAZ and WAZ scores compared to boy children, a finding that is consistent with previous findings of son preference in China.

Nutritional deprivation among children is still a major concern in China, and this article has pointed to the government's response to internal migration as one of the barriers to improvements in children's well-being. Overall, the results point to the importance of revising the *hukou* system, so that children who migrate to urban centers with their parents are not suffering from denial of public services and economic hardship that arise from their rural *hukou* status. Improving the accessibility of public services in urban areas for rural-urban migrants will also make it more likely that parents bring their children with them rather than leave them behind, thus mitigating another disadvantage for children's nutritional status caused by China's inequitable system of household registration. This argument is particularly true for the provision of public education to migrant children in urban areas. As the literature review made clear, China still has major imbalances in the quality of education that young people receive, and these imbalances are particularly severe between urban-born children and rural-born children attending urban schools.

Results from this article also support the implementation and enforcement of a number of other policy interventions, particularly those that support migrant parents' roles as caregivers of young children at the same time that they are employed in productive market-based activities in urban areas. Such policies are consistent with the proximate determinants framework in which improved socioeconomic status for parents contributes to children's nutritional status through the parents' ability to provide healthier foods, better health care, and safer environments. Of particular importance is a transformative approach that boosts the remunerative value and security of migrants' jobs and improves the compatibility of market work with childcare. Greater public support of out-of-home childcare services will help to relieve the time and budgetary constraints that migrant workers experience. Childcare issues pose a relatively greater constraint on participation in the labor market for rural-urban migrant women than for their urban non-migrant counterparts, and this constraint is largest for migrant women with pre-school age children.[46] Lack of affordable quality childcare in urban areas is a major reason why parents leave their children in the care of relatives when they migrate, and also why migrant women wind up dropping out of the urban labor force if they do migrate with their children. Subsidizing childcare services for migrant households in urban households could generate substantial welfare gains compared to these other two options. Public support for early education programs also directly benefits those children who otherwise could be receiving inferior-quality care from alternative providers.

Even with these improvements in urban areas, children will inevitably be left behind in rural areas for various reasons related to household circumstances. It is imperative that the government try to improve

[46]Margaret Maurer-Fazio, Rachel Connelly, Lan Chen, and Lixin Tang, 'Childcare, eldercare, and labor force participation of married women in urban China, 1982–2000', *Journal of Human Resources* 46(2), (2011), pp. 261–294.

the lot of these children by investing more in the needs of rural-sector households. Relatively greater poverty, lower rates of wage-employment, poor infrastructure, and lower educational attainment in the rural sector reflect long-term patterns supporting the argument that gains in prosperity since the late 1970s (when the Chinese economy embarked on its rapid growth trajectory) have not been evenly distributed.[47] Policy reforms to address these disparities include investment in rural infrastructure and improvements in the design of China's public safety net. Evidence indicates that although enrollment in primary school is nearly universal among young children, there is large attrition in the rate of children continuing onto secondary school, especially for girls living in rural areas.[48] Policy reforms that improve access to schools, the quality of education, and incentives such as free lunch programs so that children remain in school will go a long way to close these gaps. Improved nutrition policies in rural areas such as vitamin supplement interventions will also help to improve school performance and reduce attrition.[49] Policies of this nature lend themselves to win-w*in situ*ations in terms of being both pro-rural sector as well as pro-children.

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